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Thos. Windsor Esq
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MANCHESTER
MEDICAL
SOCIETY

PARTURITION AND OBSTETRICS.

"The whole question of abortion and parturition, and in a word, of *Obstetrics*, as a science, is one of the true spinal system."

DR. MARSHALL HALL.

Diseases and Derangements of the Nervous System, 1841.

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PARTURITION

Thomas Windsor

AND

THE PRINCIPLES AND PRACTICE

OF

OBSTETRICS,

MANCHESTER MEDICAL SOCIETY

BY

W. TYLER SMITH, M.D. Lond.

LECTURER ON OBSTETRICS IN THE HUNTERIAN SCHOOL
OF MEDICINE.

LONDON:
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TO

MARSHALL HALL, M.D., F.R.S.,

PREFACE.

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I BEGAN to study Reflex Obstetrics in 1842, and the present work is the result of seven years' close and earnest attention to the subject. I may say truly, that during this time, though much occupied by other matters, it has scarcely ever been absent from my waking thoughts.

I have no wish to deprecate criticism, but I trust I shall not be considered merely in the light of one who applies facts and principles already known to his own department of practice. I believe every candid person conversant with the current knowledge of the Reflex Function, and of Obstetrics, when I began to write, must admit that I have both added to reflex physiology, and made extensive applications in practice, which had eluded previous observers. Indeed, reflex obstetrics is a new department of the reflex function and its applications. Taking the whole range of reflex physiology, the Cause of Labour is only second in importance to the Cause of Respiration, and no one had perceived that the relation of the ovarian nerves to parturition is the same as the relation of the pneumogastric nerves to respiration; while, in the investigation of the causes of the

Genesial Cycles, in the Twelfth Lecture, I have entered upon a new field, altogether distinct from the reflex motor function.

When I published my first "Observations," reflex physiology had not found even a verbal home in any work on obstetrics, but I do not think it will be possible to say the same of future works in this department of medicine.

Bolton-street, March, 1849.

CONTENTS.

MANCHESTER MEDICAL SOCIETY

LECTURE I.

PAGE

Introductory 1

LECTURE II.

Obstetric Ideas: — 1. Development. — 2. Mechanism. — 3. Motor Action. Present disunion between science and practice. Sketch of the progress of the nervi-motor physiology of parturition 15

LECTURE III.

The different forms of motor action observed in human parturition: volition; emotion; reflex action; peristaltic action, or contraction from the irritability of the uterine muscular fibre 31

LECTURE IV.

The nervi-motor actions of the Fallopian tubes in menstruation, coïtus, conception, and parturition. Nervi-motor actions of the vagina in the unimpregnated and parturient states . . . 51

LECTURE V.

The nerves of the uterine system; distributive anatomy of the nerves of the ovaria, Fallopian tubes, uterus, vagina, and external parts of generation; opinions of John and William Hunter. Growth of the uterine nerves during utero-gestation 62

LECTURE VI.

PAGE

Puberty. History of the ovular theory of menstruation. Analogy between menstruation, œstruation, and the oviposition of birds, insects, amphibia, and fishes. Nature of the catamenial secretion. Diseases of menstruation. Sterility, amenorrhœa, dysmenorrhœa, and ovarian convulsion. Practical applications 76

LECTURE VII.

The principal motor phenomena of pregnancy—Emesis, cough, tenesmus, strangury, cramp, and the abdominal movements. Elucidation of the real nature of the movements generally considered to belong entirely to the fœtus 92

LECTURE VIII.

Difficulties attending the inquiry into the cause of labour. Sexual excitability in the frog. Cause of parturient action in oviparous fishes; in oviparous insects; in birds; in mammalia; in the human female. Relation between ovarian excitement, sexual excitement, and coïtus. Relation between oviposition, œstruation, menstruation, conception, and parturition. The collective phenomena of ovi-expulsion 106

LECTURE IX.

Abortion a branch of spinal pathology. Ex-centric causes of Abortion. Irritation of the mammary, trifacial, vesical, ovarian, rectal, vaginal, and uterine nerves. Centric causes of abortion. Blood-poisons. The exanthemata, syphilis, scrofula, mercurialization, carbonic acid, specific uterine excitants. Emotion. Mechanism of abortion 127

LECTURE X.

The prevention of abortion. Removal of mammary, dental, vesical, ovarian, rectal, vaginal, and uterine irritation. Uterine, placental, and fœtal disease. Respiration of the fœtus. Intra-uterine pathology. Prevention of abortion from habit. Epidemic abortion; hæmorrhage in abortion; treatment of abortion. Eradication of the abortive diathesis 138

LECTURE XI.

PAGE

Physiological stages of Labour:—I. The Preliminary stage.—II. The stage of Dilatation.—III. The stage of Propulsion.—IV. The stage of Expulsion.—V. The Supplemental stage. View of the order of motor action in parturition. Anæsthesia in obstetric practice. Parturition at the boundary between pathology and physiology. The physical pain of parturition. Ovarian, uterine, vaginal, pelvic, perinæal, and lumbar varieties of labour-pain. Physical pain and physical shock. Aggregation of reflex arcs in the medulla oblongata and the medulla spinalis inferior 153

LECTURE XII.

Remarks on Periodicity. Reciprocal actions between the ovaria, uterus, and mammæ. Neural actions of a physiological kind established between the organs of reproduction. Explanation of the catamenial periodicity. Explanation of the periodicity of gestation. Explanation of the periodicity of lactation. The Great Genesial Cycle. Objects of the periodic arrangements. Practical applications 175

LECTURE XIII.

The first extra-uterine phenomena of respiration. Changes in the fœtal circulation. Arrest of the placental circulation and respiration. Establishment of respiration in the infant. Congenital asphyxia. Motor phenomena and congenital asphyxia in different animals. Opinions of Prof. Volkmann, Drs. Marshall Hall and Edwards. Treatment of congenital asphyxia before birth and subsequent to delivery. Intra-uterine causes of asphyxia. Separation of the umbilical cord. Secondary asphyxia 189

LECTURE XIV.

Applications of Physiology to obstetric Pathology and Therapeutics:—1. Disorders arising from excess of nervi-motor action.—2. Disorders arising from perversion of nervi-motor action.—3. Disorders arising from deficiency of nervi-motor action. The relation of nervi-motor action to instrumental delivery and manual operations. A new classification of obstetric therapeutics 205

LECTURE XV.

PAGE

Causes of excessive uterine action ; ovarian irritation ; emotion ; early rupture of the membranes; voluntary efforts; position of the patient; the fœtus; state of the circulation; digitation. Rules for manipulation in precipitate and tardy labours. Sedatives of excessive parturient action; ovarian treatment; bleeding; nauseants; opium; regulation of emotion; the abdominal bandage, &c. 216

LECTURE XVI.

Rupture of the uterus; causes of this accident. Excessive motor action of the uterus itself. Prevention of uterine rupture. Importance of moderating excessive uterine action. Laceration of the perinæum; causes of this accident. Observations on the prevalent plan of supporting the perinæum by manual pressure during labour 229

LECTURE XVII.

Rigidity of the os uteri; different forms of rigidity; Treatment. Encysted placenta; nature and treatment of this affection. Hour-glass contraction; seats of contraction; its causes and treatment. Inversion of the uterus; mechanical and motor theories; description of this accident; re-position of the uterus. After-pains; their causes and treatment 243

LECTURE XVIII.

Extra-uterine reflex actions of an abnormal character, occurring before, during, and after parturition. False or spurious labour-pains. Metastatic pains. Reflex actions affecting the stomach, abdominal muscles, bladder, intestines, heart, larynx, &c. Rigors. Diuresis. Partial convulsive action. Tympanitis. Reflex counter-irritation. The sensation of the draught in the breasts. The motor actions of the mammæ 257

LECTURE XIX.

Natural and morbid conditions of the reflex function in the infant at the time of birth. The influence of muscular tone. The Colostrum. The Meconium. Icterus Neonatorum. The acts of suction and deglutition. The state of the infantile mammæ. Morbus cerulæus. Tetanus nascentium. Congenital contractions of the extremities 268

LECTURE XX.

Puerperal Convulsion. Opinions of contemporary authors in this country respecting the cause of puerperal convulsion. Extracts from Drs. F. H. Ramsbotham, Rigby, Burns, Robert Lee, Fleetwood Churchill, Locock, Collins, and Merriman. Opinions of Dr. Marshall Hall. The cerebral hypothesis; its errors, and the causes which have given rise to them. Convulsion really referable to the spinal marrow and not to the brain. Post-mortem fallacies. Causes of the cerebral phenomena of convulsion. Modes in which morbid states of the cerebrum may cause convulsion. Distinction between cause and effect in the pathology of this disease 278

LECTURE XXI.

Centric causes of puerperal convulsion. Cerebral counter-pressure. Irritation of the spinal centre. States of the blood. Emotion. Atmospheric influences. Eccentric causes of convulsion. Irritation of the uterus. Irritation of intra-cranial excitor nerves. Irritation of the ovaria. Irritation of the bowels. Irritation of the stomach. Irritation of the bladder, &c. Summary of causes 292

LECTURE XXII.

Physiology of sleep. Convulsive erethismus; sphagiasmus; laryngismus; odaxismus; pharyngismus; cardiasmus, The convulsive paroxysm. Relation of convulsive action to labour-pains. Relation of puerperal convulsion to epilepsy, puerperal mania, apoplexy, and cerebral syncope, &c. 309

LECTURE XXIII.

Bloodletting in puerperal convulsion. Dilatation of the glottis.—Application of cold. Administration of opium. Regulation of emotion. Treatment of sphagiasmus and cervical muscular action. Removal of the reflex causes of convulsion. Evacuation of the stomach, bowels, bladder, and uterus. A case, and a commentary thereon 329

LECTURE XXIV.

Causes of uterine inertia. States of the liquor amnii. State of the abdominal muscles. Uterine displacements. Peculiar dangers

PAGE

of the propulsive and expulsive stages. Complication of labour with thoracic, abdominal, and paraplegic disease. Causes of deficiency of excito-motor action. Treatment of uterine inertia. Rest. Opiates. Evacuation of the liquor amnii. Examinations. Stimulant enemata. Abdominal bandage. Position. Ergot of rye. Galvanism. Instrumental interference . . . 344

LECTURE XXV.

The Treatment of uterine hæmorrhage:—I. By exciting reflex uterine action; II. By direct or centric utero-spinal action; III. By exciting the uterine muscular irritability; IV. By mechanical measures; V. By astringents and refrigerants. Profound importance of the application of physiology to practice. Proper organization of remedies 357

LECTURE XXVI.

Hæmorrhage at different periods of gestation. The principle of alternation in the application of cold or other stimuli to excitor nerves. Hæmorrhage at the commencement of the early and latter months of gestation. Hæmorrhage in placenta prævia. Hæmorrhage occurring during labour. Principle of the arrest of hæmorrhage in placental presentation. Hæmorrhage occurring after delivery. Conclusion 372

APPENDIX 383

PARTURITION AND OBSTETRICS.

MANCHESTER MEDICAL SOCIETY

LECTURE I.

INTRODUCTORY.

Labour: the study of the act of parturition itself, and of all that relates to the prevention or alleviation of the pangs and dangers in which women bring forth children, and to the preservation of their offspring, are the principal aims of the Obstetric Art.

I propose, in the present lecture, to institute a comparison between British and Continental obstetric medicine, for I think I shall be able to deduce from such a comparative examination, better than in any other way, the great fundamental principles upon which obstetric practice is founded—principles to which we may refer the differences that prevail in practice in this country and on the Continent, and which will also explain some of the perturbations which have recently crept into the British school.

The excellence of Obstetric Medicine is one of the most emphatic expressions of that high regard and estimation in which women are always held by civilized races. The state of the obstetric art in any country may be taken as a measure of the respect and value of its people for the female sex; and this, in turn, may be taken as a tolerably true indication of the standard of its civilization. Schlegel, alluding to the historical growth of nations, calls the institution of marriage the real commencement of civilized life. It may be declared as a truism, that obstetric science must flourish most in countries where the marriage tie is most respected,—where women are held in the highest esteem.

Long ago the philosophic Denman pointed out the influence which Christianity had exerted on obstetric practice, by substituting monogamy for polygamy, and enforcing a strict observance of the marriage tie—moral reforms which gave increased value and consequence to every means that science or art could devise for promoting the health and safety of individual women. Prayers for the welfare of "all women labouring of child" have a place in our national liturgy, and the interest they excite is progressive with every generation, and pervades all classes of society.

But in this country respect for women and reverence for the rites of marriage have an origin even anterior to the introduction of Christianity amongst us. In the palmy days of the Roman Empire, the stock from which we are mainly sprung was celebrated for the practice of these virtues in its heathen state. We may say, without arrogance, that we have cherished and developed the attributes described by Tacitus as belonging to the Teutons, in the ancient forests of Germany. They held their women sacred; and of their respect for the marriage tie, the historian wrote—"Severa illic matrimonia; nec ullam morum partem magis laudaveris."

The influences of civilization and religion, and subsequently the spirit of chivalry, have alike combined to cultivate the noble instincts which signalized our barbarian ancestors. Such is the true foundation of our national midwifery. This is tracing a high descent for the obstetric art, but not a higher one, I believe, than is justly its due. Our ideas of social progress are intimately connected with an elevation of the character and position of woman; and it is not too much to say, that in no country of the world, in no age of its history, has woman been more valued and honoured than in our own country, and in the present times. We may look to obstetricy for a verification of the truth of this position. Medicine is no respecter of sex. The health of woman, in all that relates peculiarly to the sex, has claimed the intellect of the greatest disciples of the profession of healing—of our Harveys, our Hunters, and our Jenners. If any comparison of the value of human life can properly be made at all, it may be truly said, that no life seems so valuable as that of a woman in childbirth; for at no other moment can the lives of two human beings be so closely linked together. British obstetricy, then, may fairly be considered as an expression of our social condition—of our humanity towards women and children; and there is no branch of medicine which more commends itself to the genius of the English people.

Under these combined influences of race, civilization, and religion, modern obstetric practice has gradually advanced, in the face of greater obstacles than have beset the elder branches, to be acknowledged as one of the three primary departments of medicine. It has, in process of time, triumphed over the objections which natural reserve placed as barriers against male attendance, and which were, for a long time, the main prop of the midwife—a triumph which has well-nigh transferred the allegiance of the lying-in woman from Lucina to Apollo. This transfer the future must complete.

In private practice, in this country, the midwife is very much out of date, belonging to a bygone, rather than to the present age. The great mass of our obstetric practice is a ministration of education and experience, such as no endeavours could impart to a body of females. Yet this venerable personage has still some hold on midwifery—a hold which I believe to be not less unfavourable to the safety of mothers in parturition, than it is derogatory to the obstetric art. The signs of her existence are occasionally seen in the glowing report of some lying-in charity, the advertised sale of a child's cawl, or the newspaper report of a fatal childbirth accident.

I take an address which has been issued by the managers of the largest lying-in charity in London, the Royal Maternity, from which it appears, that during the last year upwards of three thousand women have been attended by midwives in London, Westminster, and Southwark. Now, I believe it to be degrading to the obstetric branch of medicine thus to have it admitted, on a large scale, to be right and fitting that parturient women should be attended by midwives, however well instructed, or however "honest, skilful, and humane" they may be. To the charity I refer to, three able and experienced obstetric physicians are attached; but it is and ever will be in

MEDICAL

the nature of things, that under female attendance, with the very best disposition to obtain the assistance of the physicians in difficult cases, the lives of women must slip through their hands, when, if an educated accoucheur had been in attendance throughout, such lives would have been, humanly speaking, preserved. I think the progress of this branch of our art will hereafter demand that the office of the midwife be abolished altogether; and in the particular instance referred to, I think it would be as easy to find, if necessary, three hundred educated medical attendants for the charity, as the three physicians, who, I believe, undertake their duties without fee or reward. If midwife-practice be less safe than attendance by an educated medical practitioner, it is a very questionable charity to supply it to poor women. There ought not to be one attendance for the rich, another for the poor, and it is not so in charities relating to general medicine and surgery. Charity should apply itself to obtain the same aid for the really necessitous poor as the rich are able to command. What should we say to a public institution for the spread of inoculation after the superior efficacy of vaccination had been tested! I have referred to a particular charitable institution, not for the sake of invidiousness, but because I believe it to be the first and best of its kind; and if respectable and well-organized charities did not sustain a corps of midwives, the race would soon become extinct. If they were not legitimatized by lying-in institutions—diplomatized as "honest, skilful, and humane" in these reports—they would not exist to enter into competition with the general practitioner in the poorer walks of practice, and in poor-law unions; the two sexes would no longer exist in a kind of obstetric partnership, which, while it exists, will be pointed at, to the disadvantage of the obstetric physician and surgeon, and the art itself; and will be detrimental to the safety of lying-in women. These are among the worst things that can be said of British obstetric practice. It may tend to their removal to hold them up to the professional eye; but it must be remembered that in Great Britain, attendance by midwives is, after all, the exception, while in other countries it is the rule. It should be the steady aim of every man engaged in obstetric practice, whether as a distinct branch, or in connexion with medicine and surgery, to discourage midwife-practice. This department of the profession will never take its true rank until this reform has been effected. Modern medicine and surgery had, like midwifery, to emerge from embryo states; but they emerged so long ago, that they entertain some degree of contempt for the more modern birth of obstetricy. The obsolete power of conferring the degree of Doctor of Medicine, possessed, I believe, by the Archbishop of Canterbury, is the only relic of the transfer of medicine from the monk to the physician; and the emblematic pole is the only remnant of the passage of chirurgery from the barber to the surgeon. We may confidently hope, that hereafter the sign of the escape of obstetricy from the midwife will be equally obscure and insignificant, and that the very term *midwifery* will be rejected on account of its derivation. Every step of scientific advancement widens the distance between the mere midwife and the educated accoucheur.

I think we may take the state of obstetricy in France as the type of continental practice, and I do not think the British school need fear the most severe comparison. Almost all observers concur in the opinion, that throughout the Continent the ties of marriage are less severely observed than in this country. The social organization is less favourable to domestic union and constancy. This is reflected with tolerable accuracy in the general condition of the obstetric art. We must ever honour the names of Ambrose Paré, Guillemeau, Mauriceau, Portal, La Motte, and others of the older French school, as among the great fathers of modern midwifery; but I think it will be granted that contemporary habits and manners in France are unfavourable to the general cultivation of midwifery as a branch of the profession claiming equal dignity and usefulness with medicine and surgery. The obstetric art must, I have maintained, flourish most where woman is held in the highest esteem. We may admit that the French are a polite people, but they have their paradoxes in matters of feeling, as well as in politics. Gentlemen on the other side of the Channel most earnestly assist the fold of a shawl, or perform slight services with the greatest gallantry and devotion; yet they consign their women, in the hour of travail, to the care of her own sex. Such is the fashion and custom of the time. It is well known that the *sage-femme* of France is a very superior person to the old English midwife, now so much out of date; but all cannot be Boivins or Lachapelles, and the emergencies of midwifery often call for as stout a courage, and an action as stern and instant, as any of the emergencies of surgery. It is not among such scenes that the female heart and mind are fitted to excel—unless, indeed, we can ensure a race of Amazons. The prevalence of *sage-femmes*, and their modes of notifying themselves to the public, must inevitably tend to throw an air of ridicule over the obstetric department of medicine in France. Even in the most aristocratic quarters of Paris—the Rue and Faubourg St. Honoré, for instance—the "*sonnette de sage-femme*," or the door-bell of the midwife, may be seen with a miniature picture of the smart midwife herself, in oil colours, over it, in the act of presenting a fine baby to all comers. Or there may be observed paintings of more pretension, giving the passer-by the penetralia of the lying-in room, and containing full-length portraits of the accoucheuse and the everlasting baby, with an interesting view of the lady-accouchée in bed in the background; the not over-delicate painting by Rubens, in the gallery of the Louvre, of the delivery of Marie de Medici, reduced to common-place—the *sage-femme* doing the work of the angels of that celebrated artist.

I assume it as beyond contradiction, that in France, and on the Continent of Europe generally, from various concurrent causes, women are treated with less delicacy than in this country; less tender consideration is shown for their feelings, and even their lives, than with us. In France, which I have taken throughout the present lecture as the type of the Continent in these respects, freedom of examination has produced greater familiarity with uterine disease than we possess, and so far, perhaps, an important point has been gained; but in practical midwifery there is greater recklessness in the use of instruments, and more love of formidable and cruel operations, than would be tolerated in England. French vivacity, the love of striking novelty and of heroical action at any cost, seem to find place even in their professional dealings with women. In midwifery, France produced Sigault, to whom it decreed an ovation for his section of the symphysis pubis, and

Lisfranc, whose chief boast was of the number of times he had mangled the womb; and if France had the great glory of abolishing the actual cautery from surgery in the days of Ambrose Paré, it must take the greater odium of introducing the barbarous application, in modern years, of iron at a white heat to the living body, for the treatment of uterine disease. Even the freedom of examination to which I have alluded, though productive of some good in a diagnostic point of view, is carried to such an extent of indecency in the French hospitals, as to make medicine the ally of immodesty and demoralization, rather than of decency and virtue. It would be difficult to say whether the indecent and public exposure of their women inflicted the deeper wound on the modesty of one sex, or the morality of the other.

But the differences between obstetric practice in this country and in France are differences induced by religion still more than by the social status of the two countries. There may be traced throughout the range of obstetricy a Roman-catholic and a Protestant bias of practice. I am not here going to draw any unfavourable picture respecting the professors of one religion or the other; but the truth may, I hope, be spoken without offence. The Catholic doctrine of the value of extreme unction as regards the mother, and the necessity of baptism to infant salvation; the different views on these points held by Protestants; are visibly written in the precepts of practical midwifery: and though other circumstances complicate the matter in some particulars, I think we may fairly take France and England as the types of the two great varieties of practice which exist. In France, the safety of the life of the child is in many cases held practically to be of more importance than that of the mother. We may see this in the preference evinced for the Cæsarian section; the rash use of the long forceps; in times past, for the Sigaultean operation; and in the long-cherished dislike to the induction of premature labour, or the performance of craniotomy, under any circumstances. In England, we see the preference given to the mother, in the performance of craniotomy, as though the child were already dead, in all cases where the life of the mother is imminently endangered; and in the general reception of the principle, that when the pelvis is greatly deformed, or when the health of the mother is seriously imperilled from other causes during utero-gestation, premature labour should be induced: we see it, too, most forcibly, in our dislike to the Cæsarian section, and in our ancient hatred of Sigault. To unravel the direct and collateral bearings of religious opinions on obstetric practice, in different countries, would not only aid us in the selection of principles of action, but it would also account for many of the anomalies which exist—the *idola* of the tribe and of the market-place which infest obstetrics.

The following division will present more strikingly the differences between British and Continental opinions:—

PROTESTANT practice gives a decided preference to the life of the mother. This is seen—	ROMAN-CATHOLIC practice leans to the life of the infant. This is seen—
In the partiality for craniotomy.	In the favourable opinion entertained of the Cæsarian operation in Roman-catholic countries.
In the induction of premature labour.	
In the proposed separation of the placenta, in placenta prævia.	In the high opinion in which the Sigaultean operation has been held.
In the dislike of the Cæsarian section, the Sigaultean operation, and the frequent use of the long forceps.	In the frequent use of the long forceps.
	In the great dislike to craniotomy and the induction of premature labour.

In all cases in which it may be possible to save both lives, of course the injunctions of Protestant or of Roman doctrines would be equally emphatic. The same beneficent dictates would flow from each, but there can be no doubt there would exist a latent or explicit bias in the minds of communities of Protestants or Roman Catholics. This influence, if not existing, *per se*, to the mind of the accoucheur, must affect his practice, from the insensible bearings of the clerical and public mind upon professional men. And many medical men, of either church and country, who have never examined themselves as to the bases of their opinions, would yet hold most tenaciously to the different lines of practice.

It may be argued, against these views, that the French are not a religious people at all. But Roman-catholic ideas were so long dominant in France, that more generations of free-thinking or philosophy than have elapsed since the time of Voltaire, would be necessary to eradicate the influence of religion from her laws and customs. That which had been scoffingly thrown aside as matter of faith, would still remain in many forms of hereditary prejudice; and in midwifery, that lament of the elder French accoucheurs for the soul of a fœtus lost during delivery, though it might excite ridicule, would still find its representative in practice. It may be objected, also, that the peculiarities of practice which I have termed continental are found in America. To this I would reply, that notwithstanding the blood-relation between the United States and this country, American midwifery is far more the child of France than of England.

Various causes have in late years been operating to efface the line which separates the two schools of practice. The editor of the late *British and Foreign Medical Review*, in the valedictory address which sums up the various merits of that publication, alludes especially to the copious introduction of the treasures of foreign medical literature into its pages. As regards medicine and surgery, this may have proved a boon; but in the case of midwifery, it may be fairly questioned whether familiarity with continental literature and practice has not tended to confuse the principles which should rule in this country. If the variations of practice could be referred to purely scientific standards, midwifery, as well as medicine and surgery, might become cosmopolitan; but midwifery must inevitably differ in different countries so long as the present differences of religious faith exist, unless, indeed, we should reach that happy period when the interests of mother and offspring should never clash.

It will be useful to study the bearings of these different principles upon disputed points of practice, and particularly upon the newly proposed or revived plan of detaching the placenta, and extracting it before the child, in placental presentations. I believe examination will show that this practice is an excessive and unjustifiable application of the British rules of practice, one which, if it were allowed to prevail, would subject us to more reproach, on the score of indifference to the life of the child, than craniotomy, with all its horrors, has ever brought upon us. For an assumed, but unproved, advantage to the mother, it does not hesitate to sacrifice the life of the fœtus. On the other hand, the established practice—

that of turning and extraction—is one which gives a reasonable prospect of safety both to the mother and the child. The new treatment, notwithstanding all that has been said to the contrary, is probably not more safe to the mother than turning, while as regards the fœtus, it is almost as fatal as craniotomy. Statistical tables have, it is true, been adjusted, in which turning has been conveniently termed "the old method of practice," and under this designation, cases of death before any treatment whatever had been applied, cases of death in the hands of midwives, cases in which death followed at the end of the puerperal period, from phlebitis or fever, and other heterogeneous cases, have all been grouped together, and laid to the account of turning in placenta prævia. Tables thus unfairly concocted have been compared with picked tables, in which the placenta was uniformly detached and expelled before the child. But you will see, that if any fair and honest comparison is to be made, the respective cases in which either turning was performed or the placenta detached should alone be brought into comparison. Pure cases of turning should be placed on one side, and pure cases of detachment on the other. It would be quite as just to set down the cases of death before assistance had reached the patient, or before any treatment had been adopted, to the account of the treatment by detachment, as to the treatment by turning. Properly they belong to neither class, but they have been used most unscrupulously in the tables of mortality from turning, to alarm practitioners about the propriety of the established practice. Again: if statistical tables are to be framed and depended on, we ought to have tables of the mortality to the infants as well as of the safety to the mothers from the new practice; but such tables have not, as far as I have known, been yet prepared. Things to be compared should at least be comparable. Tables of turning should not admit of being turned. In a word, obstetricians can only decide for or against the newly proposed method, by having the results both to the mother and the child in veritable turning, and the results to the mother and the child in an equal number of true cases of placenta prævia, in which the placenta was actually detached artificially. Cases have been ranked as successful cases of placenta prævia, treated by detachment of the placenta, when there was good reason to believe that the placenta had never been attached at all at the os or cervix uteri, but had apparently descended from the fundus uteri. At the present time, the advocates of the new proposition have contrived to envelop it in great suspicion as regards the mother, while, as regards the child, detachment is confessedly a most dangerous operation. It stands next to craniotomy. Instead of removing the brain, it produces asphyxia, and the one is almost as fatal as the other.

Whether accoucheurs in France and Germany will be charmed with anything martial in the proposed practice it is impossible to say; but if they decide according to the principles of their national obstetricy, we may expect, should it reach them for discussion, a most determined censure and opposition. Indications of this are not altogether absent at the present time. If the principles of continental practice are supported, this proposal will be put in the same category as craniotomy. It will be considered as a disgraceful excess of the British principles of practice. There is one singular circumstance which cannot fail to strike you when pointed out: this is, that the self-same accoucheurs who, in the matter of placenta prævia, are carrying the principles of our national practice, as I believe, to an injurious extent, are those who attempt to violate them, on the other hand, by adopting in other cases the foreign and antagonistic principles. The same practitioner who one day destroys the child by the detachment of the placenta, will, the next, endanger the life of the mother by the Cæsarian section, vacillating between the extremes of either practice; clearly showing to my mind that such persons are little influenced by principles or principle, but that they are animated by a love of startling novelty, an affectation of heroical dealing, and a thirst for notoriety, rather than by a desire for true and honourable fame.

It becomes us, therefore, to examine the value of the points of difference, to know the ground upon which we stand, and not from any mere habit or fashion to suffer a laxity to creep in upon points where, if a nice conscience be not kept, we may be guilty of sacrificing lives which we were bound to have preserved. In midwifery, it sometimes happens that we have two evils before us, and we must firmly fix in our minds which of the two we must most avoid, whether the death of the mother or the death of the child is to have our preference—to save both is frequently impossible. And we must remember that that which may be conscientious in a Protestant country may be criminal in a Roman-catholic community, and *vice versa.* I have attempted to vindicate British midwifery, and to draw attention to the principles upon which it rests; and recent events have shown that some vindication is necessary, unless we are prepared to resign its distinguishing characteristics and practice without the substitution of any principles whatever.

In this country, the attention of the accoucheur is directed singly and solely to the *lives* under his care. LIFE is the sacred object of all his efforts. Setting aside every other consideration, his skill is addressed to its preservation ; and no man, thoroughly imbued with the principles of our national practice, would dream of raising the value of the life of the fœtus to an equality with the life of the mother. Even with this important point settled on a firm basis, cases of conscience, such as might puzzle the nicest casuist, must often arise. Hence the tender consciences of the elder obstetricians, and their frequent meetings in grave Congress or Diet, as it were, for deliberation, and for the division of responsibility when any vital changes were proposed in practice. The physician has frequently to hold the rod of Esculapius, like the brazen serpent, between life and death; but there is no position of greater or equal responsibility in the entire range of the profession, than that in which the accoucheur has to choose between the life of the mother and her child,—when the mature and the as yet glimmering torches of life are both in danger, and the one can only be relumed by extinguishing the other,—when to do this is the only way of escape from the sacrifice of both.

Though, as an Englishman, I should, of course, give the preference to our national practice, I can see some points in which we are inferior to our continental neighbours. Either from an improper insensibility respecting the lives of children, or from some cruel and unjustifiable desire to punish guilty mothers, when punishment can only fall jointly on them and their innocent children, society in this country almost abandons the unmarried pregnant woman and her illegitimate offspring. Our lying-in institutions generally exclude unmarried women from their benefits—a most unnatural course of action as regards the innocent children they are about to bear, and an assumption, by human hands, of the awful severity of the decalogue. According to the rigour of even our criminal law, the pregnant woman with a quick child is not executed until after her delivery; punishment does not descend upon her till her innocent offspring has been rescued from the womb. But society does not thus suspend its severer code for the unmarried woman about to become a mother; it makes an unnatural alliance between punishment and mercy. Can it be wondered at, that in such a state of things, infanticide should be greatly on the increase? In France, on the contrary, either from greater indifference to such faults on the part of women, or from a greater humanity towards innocent children,—probably from both these causes,—care is taken of both unmarried and married pregnant women. Perhaps differences of religious doctrine may be at work more remotely here also.

Thus, I think I have shown that we may recognise two schools or sects of obstetricians—a maternal sect and a fœtal sect. Perhaps it is beneficial to the obstetric art that there should be these two sects in existence, the one directing its best energies peculiarly to the preservation of the mother, the other giving its attention preëminently to the safety of the child. There are two lives in question in the most dangerous cases, and by the dispensation which actually obtains, each life has its partizans. Nevertheless, in the progress of events, science and practice are not free from excesses, and it is above all necessary to salutary advancement that the profligate outbreaks of either school should be curbed. This can only be done by reference to principles. So far as I speak for myself, my dictum upon these weighty points would be little worth, but if I have appealed to principles which have been lost sight of, but which should be as lamps to our feet, my words will not fall to the ground. The two sects may, and probably do, exert a salutary check upon each other, preventing, in the main, extravagance on either side. If the eclectic spirit should have the mastery, and each should take the wisest and best principles of the other, rejecting their mutual defects, we

MANCHESTER MEDICAL

may hope for continued improvements in obstetricy, until the lives of both mother and child are guarded to the utmost possible extent. The more the obstetric art and general medicine is improved, the more hope shall we have of approaching the time when the lives of the mother and child shall never come into collision—when the painful thought of sacrificing or of risking the one for the safety of the other shall never arise to the accoucheur—when, if we may ever hope for such an epoch, there could be no difference between British or Continental, Catholic or Protestant action, the efforts of both being always exerted to save, and never to destroy. Still, during this progress, if such be possible, we must not let even eclecticism steal away our *principles* and springs of action. These must be held to without bigotry, but firmly, or we shall retard, rather than hasten, such a consummation.

MANCHESTER MEDICAL SOCIETY

LECTURE II.

THE SCIENTIFIC IDEAS OF OBSTETRICY.—1. DEVELOPMENT.—2. MECHANISM.—3. MOTOR ACTION.—THE PRESENT DISUNION BETWEEN SCIENCE AND PRACTICE.—SKETCH OF THE PROGRESS OF THE NERVI-MOTOR PHYSIOLOGY OF PARTURITION UP TO THE PRESENT TIME.

OBSTETRICY, as it exists at the present time, reveals to us, with more or less distinctness, three leading IDEAS, round which many lesser ideas have ranged themselves in the advance of this department of knowledge. These primary or leading ideas may be termed, Development, Mechanism, and Motor action. We may trace the idea of *development* up to Harvey; that of *mechanism* to Chamberlen and Roonhuysen; and the last idea—that which I have called *motor action*—belongs preëminently in its distinct form to William Hunter.

Let us pursue the analysis of these Ideas. We may perceive that of Development glimmering in the ancient axiom—*Omne vivum ex ovo;* but set forth with great distinctness in the exercitations of Harvey, *De generatione animalium.* In the original Latin edition of the work on generation, the frontispiece is an engraving of Jupiter seated on a pedestal, inscribed with the name of Harvey, holding in his hand an egg-shaped cup or vase. The Thunderer is represented opening the egg, and from its cavity all manner of living things are pouring forth,—men, birds, beasts, reptiles, fishes, and insects, are escaping to air, earth, and sea. On the symbolical vessel is the inscription —"*Ex ovo omnia,*" which is, indeed, the epigraph of the exercitations on generation. This great master in physiology plainly laid down the necessity of following the development of the ovum from the time of conception to the maturity of the fœtus, and he himself made many discoveries in this field of inquiry. Harvey also conceived the existence of a general anatomy, framed by the Creator according to one type—a conception afterwards seized upon with such distinctness, and embodied by John Hunter in his magnificent museum. Harvey, too, caught a glimpse of the progressive development of the human ovum through conditions which are permanent in the lower animals. Besides this general view of all which relates to ordinary anatomy, which follows step by step the ovum from the point when it first becomes cognizant to the senses to the perfect animal, and pursues, link by link, the meaner creatures to those highest in organization, allying together, by certain unities, the most distant products of animal life, a great additional flood of light has been thrown upon development by the use of the microscope. To the microscope we owe the discovery of the spermatic entozoa by Hamme and Leuwenhoeck, and subsequently of the unimpregnated ovule in the Graafian vesicle, by Baer. The discoveries of Schwann and others in cell-development form another era in structural anatomy and minute development. From the knowledge of the mode of increase by cells, and the cell-form of the ovule, histologists have proceeded with the study of another phase of development—namely, the modes of increase and metamorphosis peculiar to organic matter. We may hope, at no distant period, to span the distance between the wonderful cell which constitutes the minute unimpregnated ovule, and that vast aggregation of cells, variously modified, which builds up the human fabric, and of which that primary cell is the bountiful parent. Organic chemistry, again, lends another aid to the knowledge of development, by determining the material constitution of the animal tissues, and the progress of this department of science gives every promise that we shall hereafter be able to follow the assimilative atom or element from its first introduction into the animal economy to the time of its egestion, informing ourselves of all the chemical changes it has undergone in its wonderful passage through the arcana of life. Thus the idea of development has now far outgrown its beginning in embryology, and become the most extensive, perhaps, of any in the anthropological sciences. Still its origin must not be forgotten by obstetricians.

In the next place, the evolution of the Mechanical idea may be pursued. The germ of this idea must have existed wherever the act of parturition was observed. It originated, however, distinctly as such, with the first obstetric mechanists. When our countryman, Chamberlen, and Roonhuysen, in Holland, invented the forceps and vectis, and it became known that they and their descendants possessed a mechanical mode of rendering labour, as they averred, more safe and painless than it had previously been, and also of affording assistance in cases of difficult labour; everything of a mechanical nature, connected with parturition, came naturally to be studied with the greatest interest and attention. Thence arose the gradual improvements in obstetric instruments, and in the knowledge of the modes and conditions in which they should be applied. Thence, also, originated the study of the obstetric anatomy of the female pelvis, and the obstetric anatomy of the fœtal head, and of the fœtus in general. Thence we derived a knowledge of the peculiar anatomy of the separate bones, and of the complete pelvis; the articulations and soft parts; the relation of the parturient passage to other organs in the gravid state; and the perfect admeasurement of the different planes, axes, and diameters of the pelvic canal. Thence, too, came the study of the adaptation and organization of the fœtal head, the obstetric anatomy of the ovum, if it may be so called, which embraces a knowledge of the different measurements of the head of the child, and the natural provisions for its diminution when any disparity exists between the head and the pelvis; and also a knowledge of the mode in which the other parts of the child conduct themselves when the head is not the presenting part. From the growth of the same idea we derive a knowledge of what has been called the mechanism of labour, which has only recently been fully understood, consisting of an exact acquaintance with the different presentations of the fœtal head, and the various rotatory and advancing movements, and minute adaptations of position, which occur in its passage from the pelvic brim to the birth. The mechanical idea, which, when held in due subordination, is of immense value in midwifery, now pervades every department of obstetrics, and indeed it may be imputed as a fault to the practice of even the present day, that it is too purely a mechanical midwifery. In the height of the mechanical era,—at the time of Smellie, for instance, or a little after,—when the phantom was invented, an accoucheur might have been represented as a person holding a pair of callipers in one hand, and a forceps in the other; instruments were used not only in difficult, but in strictly natural labours. At the present day, time and experience have effected some great changes; but still I maintain that the improvements in obstetricy are of an empirical, rather than of a scientific character, and the misfortune of empirical, or merely practical, advancement in any art is, that it tends to magnify the individual, instead of to improve the profession. If the improvements of modern times be examined, I believe they will be found to have this fault. Now purely empirical knowledge is not communicable to others, so that when a man eminent for experience alone, dies, he takes with him much of the superiority he had acquired; whereas the man who makes any scientific progress, however humble, can both inform his fellows, and bequeathe his achievements to posterity.

The third idea I have spoken of, involving the Motor actions, or the physiological, as distinct from the anatomical, mechanisms of parturition, is of far more importance to the obstetric art than the two we have briefly considered. Fabricius ab Aquapendente distinctly taught that the contractions of the uterus, aided by the actions of the abdominal muscles, were the chief agents in parturition, but this was considered so extravagant, that even Harvey met it with direct opposition. For more than a century after the time of this anatomist, the conception of the uterus, as a muscular organ, remained in a very crude state. Obstetricians were too entirely occupied with the merely anatomical mechanisms of the pelvis and fœtus, to devote their attention to the motor powers which over-ruled them. William Hunter was the first to dwell prominently on the muscularity of the uterus. It is to the chapter in his work, on the human gravid uterus, which treats "Of the nerves," and "Of the muscular fibres of the uterus," that we must look, as the foundation of the true nervi-motor physiology of parturition. Though he wrote with doubt and hesitation, and though the things of which he wrote were surrounded by the mists of ages of ignorance and uncertainty, and hidden by the mistakes of other anatomists, this part of his works is, more than any other, the starting-point from which his genius was destined to influence the progress of obstetricy. William Hunter, even, committed excesses in following anatomy, which in his acceptation of the term included physiology, too far; witness his proposal to allow the placenta always to remain in utero until expelled by the natural efforts—a practice which was abandoned, from the fatal results which followed. However, we owe some of the happiest peculiarities of our national practice to the noble stand he made against mechanical principles — principles which have undoubtedly injured Continental obstetricy.

Denman took up the mission of William Hunter, and continued to teach a vital, or physiological, as opposed to a mechanical midwifery. It was the greatest pride of these distinguished obstetricians to transfer triumphs from Art to Nature; to repose more upon the physiological mechanisms of parturition than upon obstetric dexterity; and to exalt the wisdom written upon the uterus and its endowments, above all the skill of the hand of man. Both placed great trust in instrumental assistance, in proper cases, but both deliberately expressed their doubts, balancing the good and evil, and looking to the prevalence of merely mechanical ideas, whether, up to their times, it would not have been happier for the world if instruments had never been introduced into the practice of obstetricy. Denman even, more clearly than his great and elder contemporary, saw the direction midwifery was destined to take. Some passages in his writings are almost prophetic. Looking forward to the detection of the nature of the motor power of the uterus, and to its beneficial influence upon practice, he wrote, " At the time of labour, a new principle supersedes these of ascension and descent. This gives a disposition to the uterus to exclude whatever is contained in its cavity, and the effect produced is in proportion to the energy of the principle, and the power of the uterus. A perfect intelligence of this principle, and of the mode of its operation, would probably be of infinite use in practice, as we might be enabled to suppress the action thereby occasioned when premature, moderate it when too violent, strengthen it when too feeble, and regulate it in a variety of ways conducive to the welfare of our patients. On the knowledge we at present have of the manner in which this principle operates, and the circumstances by which it is influenced, the assistance which science and dexterity can give in cases of difficult parturition and in preventing abortions, very much depends."

It happens, singularly enough, that the practices and emoluments of both William Hunter and Denman have descended even to the present day. There are obstetricians now living who are as much the heirs of these eminent physicians as though medical practice were actually hereditary. But their representatives are the inheritors of the good fortune, rather than of the principles or ideas, of those who are, historically speaking, their forefathers. William Hunter and Denman both acted upon the noble sentiment, that it was better, and more conducive to the good of mankind, to teach and improve their art than to practise it; and thus it was that the hand of death almost fell upon William Hunter, in the lecture-room, among his pupils. But it must be confessed that their descendants have failed in the most essential qualities of their predecessors. They have acted as though midwifery had arrived at something very like perfection, as though all that remained to be done was to cultivate a lucrative practice; and I venture to predict that the hereditary line will be broken by others possessing a better conception of the spirit, and more able to wear the mantles, of these eminent accoucheurs.

I look upon it, that since the death of William Hunter only one or two great accessions have been made in physiological midwifery, and these I take to be the more perfect establishment of William Hunter's own doctrine respecting the muscular structure of the uterus, by Sir Charles Bell, and the laborious dissections of the nerves of the virgin and gravid uterus, by Dr. Robert Lee. This latter advance settles on a firm basis important points which were only anticipated by William Hunter, and which must exert an influence, not upon any special departments of obstetrics alone, but upon the entire art. We have now fairly before us nerve and muscle, with which to account for many of the unexplained phenomena of parturition. With these elements given, physiology can work out many an obstetric problem before hopeless of solution. We can also bring to our aid other and most brilliant discoveries in neurology to unravel the mysteries of nervi-motor action which have so long perplexed obstetric practitioners. But I proceed more in detail to place before you the present state of knowledge in this department.

Up to this time, obstetric and physiological writers may alike be appealed to as proving how scanty has been our acquaintance with parturition as a motor function. It is no exaggeration to say, that in the current works which treat of this subject, the opinions advanced respecting the motor phenomena of the organs concerned in parturition, are but little more certain and definite than those which were given by Harvey, as the views of Fabricius, nearly two centuries ago. The following passage, from Fabricius, quoted in the Exercitations, sets forth both the contraction of the uterus and the abdominal muscles. The anatomist of Padua taught the following doctrine:—

"The uterus being so enlarged by the bulk of the fœtus that it will admit of no further distention without danger, and thereupon being excited to expulsion, is, by the action of the transverse fibres, contracted upon itself, and so reduced into a narrower compass; and thus, whilst previously, neither the excrements from their quantity, nor the fœtus from its size, could be longer retained, the uterus, being further contracted and compressed, is still less able to contain them. Hence, first the membranes, as being the weaker parts, and more distended, give way, and the humour which is least resistant first escapes to lubricate the passages. Hereupon follows the fœtus, as being not only increased in weight, (by reason that it no longer swims in the humour,) and so descends, forcing the orifice of the womb; but also as being compressed, propelled, and expelled by the action of the uterus itself, in which action the abdominal muscles and the diaphragm admirably assist by their power of compression."

I have already stated that Harvey himself opposed these views of his teacher, Fabricius, maintaining that the fœtus bursts forth chiefly by its own efforts. To this opinion he was misled by a false analogy, drawn from the oviparous generation of birds and insects, in which the young animal generally frees itself from the egg without assistance; by reasoning from cases

CESTER
MEDICAL

of post-mortem delivery; and by considering the remarkable case of Queen Henrietta's mare—a beautiful animal whose vagina had been secured by iron rings to prevent impregnation, and thus preserve her figure and strength—but, in spite of this infibulation, she conceived clandestinely; and in her foaling, which took place without the knowledge of the grooms, the vagina was lacerated by what Harvey supposed could only have been the violence of the fœtus, but which we now know to have been the contractions of the uterus itself. He was further drawn astray by arguing physiologically from a case of labour complicated with convulsions, which induced him to consider the actions of labour similar to sneezing, or any other succussion of the system. Not even a case he relates of conception, in which there was complete prolapsus uteri, and in which abortion took place, sufficed to convince him of the general importance of uterine action in parturition. However, in the main points,—the contraction of the uterus, and the action of the abdominal muscles,—Fabricius had the truth on his side; and this, in the end, has prevailed even over the dictum of his illustrious pupil.

The relation of uterine contraction to the cerebrum and spinal cord has been examined experimentally by MM. Serres, Brachet, and Segalas; but their experiments, however interesting, are diminished in value by the fact, that they were performed before the promulgation of the modern views of the action of the nervous centres. The great aim of these able experimenters was to prove the direct influence of the cerebro-spinal centre, as it was termed, upon the uterus. In these experiments, the idea of a reflex spinal action does not, of course, obtain a place. M. Serres found that on dividing the spinal cord in gravid animals, before the time of parturition, death ensued at various intervals, but abortion did not occur. He found also that when it was divided after the commencement of parturition, the process of parturition was effectually arrested. Here were negative proofs that the spinal cord influenced the uterus; but M. Serres obtained positive proofs by exciting abortion in animals, by irritating the medulla in the lumbar region. The experiments of M. Brachet were numerous, and of a similar character. For instance, he divided the spinal cord in a guinea-pig, in which parturition was commencing. After the section of the cord, there were only some feeble movements in the lower part of the abdomen, and the animal died undelivered in three days. He repeated this experiment, and with the same result. He then ascertained that these indistinct movements of the abdomen depend on faint contractions of the uterus, and he supposed his sections of the cord had not exactly hit the origin of the nerves supplying the uterus. He devised more careful experiments, and found that on making a section of the spinal marrow, between the twelfth and thirteenth dorsal vertebræ, the uterine contractions were altogether suspended; there were no abdominal movements, and the animals died undelivered. To show that mere suffering had not influenced these experiments, he divided the contents of the vertebral canal in the sacral region, making, also, one incision down to the spine in the dorsal, and another in the lumbar region, but without dividing the spinal cord. Here the uterine contractions were unaffected, and five young guinea-pigs were produced in less than two hours. M. Brachet also relates a case of paraplegia, from disease affecting the lower portion of the medulla spinalis, which has been often referred to, in which labour proceeded with extreme inertia. M. Segalas performed experiments upon the spinal cord, and found that when the cord was divided high up, the uterus and urinary bladder still acted, but were paralyzed by division of the lower portion of the cord. The above experiments, taken together, prove irrefragably the relation between the spinal cord and the uterus; but the true nature of this connexion was unknown. The only explanation offered by these physiologists was, that a direct cerebro-spinal influence emanated from the cord to the uterus; and this was altogether inadequate to account for the phenomena of parturition.

The speculations of those who had not examined the matter experimentally were still more unsatisfactory. The function of parturition has always occupied a very humble and uncertain place in physiology. You may find it dismissed in two pages and a half of Professor Müller's great experimental work; in a page or two of Dr. Carpenter's "Principles of Human Physiology," and in three paragraphs of his "Manual;" while in the "Cyclopædia of Anatomy and Physiology," the article

"Parturition," recently published, occupies just three pages, which are entirely occupied by mere mechanism. Professor Müller, in several parts of his "Elements," speaks of the action of the uterus as peristaltic, and does not, I believe, anywhere go beyond this. Dr. Carpenter, a received authority in this country in physiology, when he published the first edition of his work, many years after Dr. Marshall Hall had made the great and comprehensive discovery of the independent function of the spinal marrow, was not aware of any reflex action belonging to the uterus; on the contrary, he taught that the uterus was independent of the spinal centre. So that if we skip two centuries, and come at once from Fabricius to our able countryman, we shall see but little difference between their opinions. In this department of physiology time has trodden very lightly, leaving but few treasures by the way. To prove this, I have only to ask you to compare the passage from the older author with the following, which contains the whole of Dr. Carpenter's account of parturition in the first edition of his work on human physiology:—

"As regards the act of parturition, there would seem reason to believe, from the evidence of paraplegia, that, of the muscles whose operations are associated in it, the diaphragm, abdominal muscles, &c., are called into action (as in defecation) through the spinal cord, but that the contractions of the uterus itself are independent of all connexion with the nervous centres. Of the reason why the muscles, which were up to that time inert, should then combine in this extraordinary manner, and with such remarkable energy, physiology can afford no certain information. There can be little doubt, however, that the stimulus usually originates in the uterus, or in some of the neighbouring organs, which are incommoded by the pressure; but it may also result from some condition of the general system, in which the uterus itself is but little concerned. It is an interesting fact, which has been more than once observed, that the fœtus may be expelled from the dying body of the mother, even after the respiratory movements have ceased. This would appear due to the contraction of the uterine fibres alone, which, like those of the heart and alimentary canal, retain their irritability longer than those of the muscles supplied by the cerebro-spinal nerves, and the power of these would be unopposed by the resistance which they ordinarily have to encounter, since the tone of all the muscles surrounding the outlet would be destroyed by the cessation of the activity of the spinal system of nerves."—p. 153.

"At the conclusion of about nine (solar) months from the period of conception, the time of parturition arrives. The uterus, by its own efforts, and by the assistance of the diaphragm and abdominal muscles, expels its contents, and the membranes of the ovum being usually ruptured before it is entirely discharged, the fœtus comes at once into the world. Respecting the degree in which the parturient efforts are probably dependent on nervous influence, some remarks have been already made. It seems by no means unlikely that the uterus, though not itself dependent on the spinal cord for its power of contraction, may contain numerous afferent or excitor fibres, and that these being compressed by the efforts of its own muscular structure, may propagate to the spinal cord the stimulus necessary for the consentaneous action of the assistant muscles. Those who may watch a labour with an attentive consideration of its phenomena, will find that the "pains" usually commence in the uterus itself, and that it is only when they become decided, that the power of other muscles is called into operation. As to the reason why the period of parturition should be just nine months after conception, we know nothing more than we do of similar facts in the physical history of man—such as the periodical return of the catamenia, the renewal of the teeth, the tendency to sleep, &c. That it is immediately dependent on some state of the constitution, rather than upon the condition of the uterus, appears from the fact, that in cases of extra-uterine pregnancy, contractions resembling those of labour take place in its walls."—p. 657.

Such was Dr. Carpenter's account, and I believe it to have been the very best explanation of this function which had at that time appeared. I ought to add, that before the appearance of the second edition of his work, I had published a short sketch of the reflex physiology of parturition, and Dr. Carpenter, at once, and with the greatest candour, adopted

MEDICAL SOCIETY

my views. You will observe, that besides uncertainty in many minor points, Dr. Carpenter at first taught, that the contraction of the uterus was independent of the spinal marrow; that physiology could give no explanation of the remarkable action of the expiratory muscles in parturition; and that we were wholly in the dark respecting the cause of labour.

The latest writer on the nervi-motor physiology of labour is Dr. Todd, who introduces the subject into his article on the "Nervous System," in the "Cyclopædia of Anatomy and Physiology." I may quote the following passage from this work, as a further and convincing proof of the confusion which prevails in this department of physiology:—

"As to the expulsion of the fœtus in parturition, while I am willing to admit that the physical power of the cord excited by the sensitive nerves, at the neck of the uterus, may exercise some influence on the contractions of the uterus, it seems to me quite evident, that the actions of this organ are reflex only to a very slight degree. In the first place, anatomy teaches us, that the muscular parts of the uterus have a very trifling connexion with the spinal cord; the nerves distributed to it being few, and these only partially derived from the spinal cord. Secondly, parturition may take place even when the spinal cord has been diseased or divided, so as to cut off its influence upon the inferior half of the body. Thirdly, it has lately been ascertained, that in women under the influence of ether, the act of parturition may take place with vigour, although the nervous power have been very considerably depressed by the influence of that agent."

In a subsequent lecture, I shall have to treat, at greater length, of the innervation of the uterus; but I may observe of Dr. Todd's preliminary admission, in the above passage, that the nerves of the cervix uteri certainly do not excite the spinal marrow by virtue of their being "sensitive nerves," for in the healthy state the cervix is at all times remarkably insensitive, and it often happens that it is insensible to the touch when parturition is proceeding with great energy.

To the first argument brought forward by Dr. Todd, with a view to prove, that the contractions of the uterus are reflex only in "a very slight degree"—namely, the argument drawn from anatomy—it may be fairly objected, that the questions recently raised, respecting the nerves of the uterus, are certainly not, as yet, *quite* decided in the negative. Some hundreds of conscientious witnesses, many of them distinguished anatomists, believe that they have seen, in the dissections of Dr. Robert Lee, the muscular and other tissues of the gravid uterus largely supplied with nerves, a considerable proportion of which are derived from the spinal marrow. But whether the muscular nerves of the uterus are large or small, we know that the uterus acts with excessive energy under the influence of emotion, and if the nerves are large enough to convey the influence of emotion to the uterus, they may well be large enough to convey the physical reflex power from the spinal marrow to this organ.

I believe Dr. Todd's "secondly," can be shown to be very untenable. He does not cite any facts in support of his assertion, while numerous experiments and facts may be adduced which directly contradict it. I may refer especially to the experiments of MM. Serres, Brachet, and Segalas, and to the cases of paraplegia detailed by MM. Ollivier and Brachet, all of which go to prove, that injury of the upper portion of the spinal marrow *does not* interfere with the action of the uterus, but that this *is* arrested or prevented by destruction of the lower portion of the medulla.

Nor is Dr. Todd's "thirdly" more conclusive. It is quite true, that parturition may be completed during etherization, but it is by no means proved, that the energy of the healthy spinal marrow is materially or generally depressed under the influence of ether, unless this agent be pushed to a poisonous extent. Dr. Todd admits that respiration is essentially reflex, and he will not be inclined to assert, that where ether has been resorted to in parturition, it has arrested the respiration. This ought to happen, to make Dr. Todd's argument consistent. In another part of his essay, Dr. Todd mentions the fact, that agents which produce convulsion or spasm do so by exalting the excitability or polarity of the spinal marrow. Now, there are many cases on record, in which spasm and convulsion have followed etherization. Such cases support the view, that ether may act as a spinal excitant, and they are quite as worthy of consideration as other cases and experiments, in which spasmodic actions have been temporarily relieved by the administration of ether.

Thus pursued, sentence by sentence, Dr. Todd's views of the non-reflex nature of parturition may be proved unsound. This physician endeavours to show, in its stead, that it is to the inherent muscular contractility of the uterus, and to the stimulus of distention, that we must refer the expulsion of the fœtus. On these subjects, Dr. Todd certainly does not display either constructive genius or analytic power.

If, on the other hand, we turn to purely obstetric writers, the real physiology of parturition is treated with equal or even greater brevity, though it is undoubtedly the corner stone, the very basis, of the Third Estate in medicine. If we examine the most recent treatises on midwifery, though, as I shall show you, the true spinal marrow plays a part so important in obstetricy, and though many obstetric works have issued from the press since the date of the discovery of the reflex function, it is remarkable that the word REFLEX, in its full signification, is not to be found in any one of them. The recently-published lectures of Dr. Robert Lee, Dr. Murphy, and Dr. Rigby, the large work of Dr. Ramsbotham, and Dr. West's Reports on the progress of midwifery, may fairly be considered as the last results of the old obstetric ideas, yet no hint is given in either of these authors, of the reflex nature of the major part of the phenomena of labour. In the course of Dr. Murphy's lectures, which appeared after I had published a sketch of the reflex physiology of parturition, the term "Reflex Function" does once occur, but it is only introduced in the most casual manner, and by way of illustration. Recently, some other obstetric writers have, in the various medical periodicals, used this term occasionally, but it has merely been the sounding of the word to the ear; there has been no investigation or comprehension of the subject. This is the simple truth, and yet I saw it broadly stated, a short time ago, by Dr. Snow Beck, that "In this country, perhaps the most generally received opinion of the action of the uterus is, that the contraction of the organ is caused by the reflex function of the spinal cord." I can only add that I wish such were the fact; but there is, indeed, scarcely a single point in the motor physiology of parturition upon which obstetricians have been agreed. They have engaged themselves with the consideration and study of the *anatomical* mechanisms, to the omission of the more important *physiological* mechanisms of the process. Of the latter, they have been content to give the merest outline or physiognomy—an outline broken, and a physiognomy deformed. Hippocrates compared the passage of the fœtus through the pelvis to the escape of an olive from a bottle; though the comparison has long been exploded, obstetricians in general have still employed themselves in studying the extrication of the olive! I venture, without fear of contradiction, to assert, that nothing like a correct analysis or synthesis of the different forms of uterine motor action, no examination of the order in which the various uterine and extra-uterine actions of labour take place, or of the reasons why they follow each other in a certain definite and regular order, will be found in any of the works of British or Foreign writers on Obstetricy.

When I began to study this subject, valuable facts relating to the arrest of uterine hæmorrhage had already been observed and acted upon by Mr. Simpson, of Stamford, and by Mr. W. F. Barlow; an excellent paper had been read before the London Medical Society by Dr. S. S. Alison, the object of which was to show the reflex nature of uterine action. In the various writings of Dr. Marshall Hall, and particularly in his work on the "Diseases and Derangements of the Nervous System," many most important facts are to be found; and he sums up the subject by declaring, that "the whole question of abortion and parturition, and, in a word, of Obstetrics as a science, is one of the true spinal system." Beyond this, I believe no one else had contributed anything of importance to the subject; and, as I have said, the very word Reflex, in its physiological meaning, did not exist in any obstetric work whatever.

Thus, then, with the exceptions just named, a few paragraphs by physiologists, a few pages by obstetricians,—and these latter chiefly occupied by the purely mechanical part of labour,—make up the sum of our knowledge of the physiology of parturition. How is this to be accounted for? It certainly is not that parturition is a less important function than digestion, or respiration, or even the circulation of the blood, all of which have been so amply investigated. The uterus has been compared by a distinguished living physiologist to the stomach, as being the organ of nutrition and support to the species. We may, with equal or even greater justice, say that the uterus is to the Race what the heart is to the Individual : it is the organ of circulation to the species. Ages are the channels in which created beings circulate; and man passes continually from the womb of his mother onwards to the womb of time. The succeeding generations of human kind, following one after another, are, as it were, the pulses of the animal Cosmos. Parturition is the systole of the uterus, the unimpregnated state its diastole, and the living beings which flow on in countless numbers in the stream of life may be likened to the myriads of globules revealed by the microscope in the circulation of the blood. In relation to the vast scheme of existence, parturition does but assume its just proportions, and assert its rights to the attention of the physiologist, as the greatest epoch in generation.

We must go on to develop the dynamical Idea, the physiological mechanisms of labour, of which, at present, there exists, within the pale of obstetricy, nothing but the bare data or formulæ for their working out — namely, the muscular structure, and the nervous endowments of the uterine system. The generation is but just passed away which denied the muscular structure of the uterus; and the very existence of the nerves of the uterus some are still found to deny. However, granting that the nerves and muscular fibres have been beautifully delineated by the scalpel of the anatomist, it remains still to study these parts in action. They exist as a picture, but they have not been studied as actors or performers in a drama; and there is even more difference between anatomy (as we now understand the term) and physiology, than there is between painting or sculpture, and dramatic representation.

LECTURE III.

ON THE DIFFERENT FORMS OF MOTOR ACTION OBSERVED IN HUMAN PARTURITION: VOLITION; EMOTION; REFLEX ACTION; PERISTALTIC ACTION, OR CONTRACTION FROM THE IRRITABILITY OF THE UTERINE MUSCULAR FIBRE.

Uterine motor action, and the action of the accessory muscles concerned in parturition, with the knowledge of the nature and laws of the forces upon which these actions depend, are the Dynamics of parturition. The phenomena of labour, and the great majority of the accidents and complications of childbirth and the puerperal period, are essentially nervi-motor; hence a definite knowledge of motor action in general, and particularly of the uterus and its associated organs, are of the first importance to the scientific accoucheur.

Precise and definite knowledge is required. It is not sufficient to say, in general terms, that the passions of the mind affect the pains, that voluntary efforts are improper, and that the gravid uterus sympathizes with various parts of the body. The motor forces, which effect the expulsion of the fœtus, at the end of gestation, must be examined, singly and collectively, by way of analysis and synthesis, with as nearly as possible the same accuracy as the chemist would use in the investigation of the simple states and combinations of the elements recognised in chemistry. The uterus is a muscular organ; it is the largest, and perhaps the most important, muscle of the female economy; and its varied nervi-motor actions must be studied just as we should study the actions of the muscles of the hand, or any other muscles more evident to observation than the uterus. In the same way, too, we must examine the extra-uterine motor actions which are brought into play during labour for the purpose of aiding the action of the uterus. Such an analysis will show us that the motor organs of parturition are endowed with several kinds of motor action, of which, as I have already said, the Reflex is the most important. The whole subject is simple, and yet difficult; the clue is distinct, but the labyrinth involved and tortuous. I must beg, throughout, your closest attention, and I sincerely wish I could be sure of rendering your minds as clear and lucid upon this branch of physiology as the crystal prism which dissects the sunbeam.

The forms of motor action which it will be necessary for us to consider are—the Voluntary, the Emotional, the Excito-motor or Reflex, and lastly, the Peristaltic or Immediate.

And first let us study the influence of *Volition*, with reference to parturition.

The uterus is altogether removed from the direct influence of Voluntary motion. The will has no direct power, either to contract or to dilate this organ. Labour may take place where cerebral paralysis exists, the will being entirely in abeyance—the movements dependent on reflex action, and peristaltic action, all remaining perfect. But though not exciting any direct influence, volition may affect the uterus indirectly. We see in certain cases of uterine inertia, where the contractions of the uterus have entirely ceased, that strong voluntary efforts are sometimes sufficient to reproduce the labour-pains. Voluntary efforts at expiration, with the glottis partially or entirely closed, cause the abdominal muscles to compress the uterus mechanically, in the first place, and this compression stimulates the uterus, and excites it to contract, in the same way as manual irritation of the organ through the abdominal parietes would do. What in other organs is called consensual action, may also, I believe, be excited to some degree in the uterus. We see that violent voluntary exertion quickens the action of the heart, and that contracting the rectus internus muscle contracts the iris at the same time, though both the heart and iris are quite removed from the direct action of volition. In a similar manner, during parturition, the uterus is probably affected in a slight degree during the intense efforts at expiration, which are made during the pains.

But besides promoting the uterine contractions indirectly, the efforts of the respiratory muscles are as much a part of labour as the contractions of the uterus itself; and volition increases, and in some measure increases and controls, the reflex and emotional actions of the respiratory muscles in the propulsive and expulsive stages of labour. The patient grasps the hand of an assistant, the back of a chair, or a towel fastened to the bed-post, and by thus rendering the thorax a fixed body, materially increases the power of the abdominal muscles. It is at this point that volition becomes directly mingled with the other motor actions of parturition.

In the next place, let us examine *Emotion* as a motor power.

A very powerful influence may be exerted upon the uterus by emotion. During labour, any sudden emotion of the mind may increase or arrest uterine action. The different effects of hope or despair on the commencement, progress, and termination of labour, have often been remarked upon. After delivery, the maternal emotion excited by the sight of the infant causes the uterus to contract in a very remarkable manner. Emotional action, like that of volition, is psychical in its nature; but it acts upon the muscular system through the medium of the spinal marrow, the great organ of physical motion; this is evident from the fact, that emotional movements may occur in parts which are entirely paralyzed to cerebral voluntary motion.

The most simple voluntary movements can hardly occur without the supervention of emotional power. It is very difficult, by the utmost stretch of volition, to reduce ourselves to mere automatons. We cannot raise a finger, without the accompaniment of some emotion which either steadies the movement, or makes it falter. In the powerful voluntary efforts of the latter stages of parturition, a considerable amount of emotion is induced; the patient often fights and rages, as it were, with her pains, and thus powerfully increases or perverts the reflex and voluntary actions. Again, reflex actions are often wisely accompanied by painful or pleasurable sensations, and these sensations originate motions which strengthen or otherwise alter the reflex motor actions.

In parturition, physical pain and the resultant emotions play important parts, aiding most emphatically, when not excessive, all the motor actions of dilatation or contraction which are concerned in this function.

In normal parturition, emotion is of greater importance than volition, as, besides the increased uterine and respiratory action which it excites, it relaxes the glottis under circumstances of danger, and by removing the expiratory pressure from the uterus, lessens, in a remarkable manner, the risk of rupture or laceration. In this way the emotion arising from the physical pain of labour is beneficial. Physical pain itself is a great trial, but it may be doubted whether, all things duly considered, women would be equally safe if they could be made to pass through labour with perfect freedom from suffering. Still, it is quite possible, in some cases, for labour to be performed in the total absence of all sensation and emotion. Labour may take place during the anæsthesia produced by ether, chloroform, or other narcotic agents. Indeed, during a certain state of the mental emotions, women have often passed through delivery in an ecstatic state, and have appeared almost insensible to pain. I have seen several instances of this kind. Women may also be delivered in a state of profound coma, or in sleep, or with the cerebral influence permanently removed, as in paraplegia from disease in the middle portion of the spinal marrow:, many cases of this kind are on record. Volition, sensation, emotion, and the expiratory actions, are here entirely withdrawn, and labour is performed solely by the instrumentality of the excito-motor power of the uterus and its peristaltic action.

We have next to consider *Reflex* uterine action.

The Reflex actions of the uterus are very numerous, and it is upon these, and the numerous extra-uterine reflex actions excited during the process, that the natural performance of parturition essentially depends. Contraction of the uterus, from irritation of the mammæ, as in the act of suckling the child; contraction of this organ from the cold water douche, applied to the vulva or the abdominal surface; contraction excited by irritating the rectum, as by stimulating enemata; or of the stomach, by drinking a gulp of cold water; of the ovaria, by the presence of the menstrual nisus; of the vagina, by manual irritation, as in "taking a pain;" of the os uteri by irritation, as in the introduction of the hand into the uterus, —are all to be considered as so many instances of reflex spinal action. Thus, in parturition, the uterus may be excited, in a reflex form, by irritation of the mammary incident excitor nerves; the pubic and abdominal branches of the intercostals; the rectal; the gastric division of the pneumogastric; the ovarian nerves; and also by the nerves of the vagina, and the os and cervix uteri.

Many of the different forms of abortion—particularly when the causes are extra-uterine—strikingly illustrate the reflex action of the uterus. A series of cases of abortion would be one of the best expositions of reflex uterine action. Abortion may be caused by irritation of the mammæ, from the sucking of an infant, after milk has ceased to be secreted, as in cases in which the mother becomes pregnant during lactation: abortion may be excited, as a morbid reflex act, from irritation of the bladder, by a calculus; by irritation of the trifacial nerve, as in cutting the dens sapientiæ; by the mechanical irritation of coïtus; by plugging the vagina; by disease of the os and cervix uteri—malignant or simple induration, inflammation and ulceration; by the irritation of the placenta attached within the uterine mouth; by ovarian irritation in ovarian disease; by irritation of the rectum, as from ascarides, and the use of irritating purgatives or enemata; by puncturing the membranes, and evacuating the liquor amnii, so as to bring the head of the fœtus to act as an excitant to the os uteri; by irritation of the inner surface of the uterus itself, in cases of blighted fœtus, where the ovum acts as a foreign body; by riding on horseback, or any other violent exercise calculated, by succussion, to bring the head of the fœtus into violent contact with the os uteri; and by other sources of irritation to incident spinal nerves which might be enumerated. All these are so many instances of uterine reflex action, the distant parts of the economy being brought into connexion with the uterus through the medium of the spinal marrow and its special incident excitor and reflex motor nerves. These facts are of most extensive practical application in devising means for the prevention of abortion.

In cases of abortion in which the irritation is applied to the os or cervix uteri, or the internal surface of the organ, the immediate action depending on the irritability of the uterus itself is called forth, in connexion with true reflex action; but in the instances in which a distal organ is irritated, there can be no doubt whatever of the purely reflex nature of the uterine action which ensues.

In the lower animals, reflex parturient phenomena are constantly observed; the expulsion of the egg of the common fowl has been caused by sprinkling a few grains of salt upon the vulva or velabrum; cold injections have been used empirically, to excite uterine contractions during foaling or calving, in the mare and cow; and the tipula and libellula have been observed, during the period of oviposition, to deposit eggs, whenever they have been shaken upon rough paper, or when the surface of the abdomen has been irritated in any way: these insects, the silkworm moth, and others, go on with the work of oviposition even when the abdominal have been divided from the thoracic portions.

But besides the uterine reflex actions, there is in the Expiratory actions, supervening in the course of labour, from the irritation of the presenting part of the fœtus, another remarkable series of reflex parturient actions, extra-uterine in their seat, but which combine and harmonize in a remarkable way with the reflex actions proper to the uterus. It is found that tumours in the vagina, or the introduction of the hand of the accoucheur, may produce the same result as the pressure of the presenting part of the child in labour. It has been noticed of tumours, which produce little or no motor disturbance while they remain in the cavity of the uterus, that no sooner do they pass from the uterus into the vagina, than "bearing-pains," as they are termed, are produced. In other words, the action of the expiratory muscles is excited in a reflex form by irritation of the vaginal mucous surface.

In fully-formed labour, then, we have to study the reflex actions of the uterus in combination with the reflex actions of the respiratory muscles, as they are excited in parturition. By these latter reflex actions, the cavities of the thorax and abdomen become involved as auxiliaries to the uterus, and their expulsory actions combine with the proper reflex action of this organ, to effect the expulsion of its contents. But there are also opportunities of observing the reflex action of the uterus singly, such, for instance, as in cases of paraplegia from disease of the middle portion of the spinal marrow. Here the reflex expiratory efforts, the influence of volition and emotion, are entirely withdrawn, it being quite impossible that these actions can be brought into play when the connexions of the uterus with the medulla oblongata and the cerebrum, the centres of the respiratory and voluntary actions, are severed. Labour is, in such cases, reduced to very simple elements, being performed solely by the reflex action of the uterus and its peristaltic power.

In natural labour, after the process has fairly commenced, it is the ovum which furnishes the chief stimulus to the incident excitor nerves, in its transit through the different portions of the parturient canal. Besides the mere enumeration of the various spinal excitors, by the irritation of which the uterus may be affected physiologically or pathologically, we shall have to study the order and succession of the normal reflex actions, uterine and extra-uterine, occurring in labour. Parturition is not one reflex act, but a function, the combined result of many such actions, aided by other powers; and we must study the preliminary phenomena, the different stages of the process, and the final accomplishment of the function; when we shall find that Nature has at her disposal a wonderful succession of stimulus and action, exactly adapted to the dilatation of the os uteri and the vagina; the propulsion and expulsion of the fœtus; and providing, also, for the safe contraction of the uterus, and its return to the unimpregnated state.

The uterus, as a motor organ, stands alone in many respects: unlike the rectum and bladder, it is not directly influenced by volition; and unlike the heart, it is extremely prone to reflex action; it more nearly resembles the œsophagus, which is uninfluenced by the will, but is endowed with reflex motor and peristaltic action. It, however, differs from the œsophagus in the great number of excitor surfaces with which the spinal system places it in relation; neither is there any other organ —not even the stomach—which acts as a spinal excitor to so great a number of organs as the uterus and its excitor nerves, whether we consider it in the impregnated or the unimpregnated states. Hence the physiological necessity for the abundance of nerves recently discovered.

Besides the reflex action of the spinal marrow and its system of excitor and motor nerves, there is the Direct action of the spinal marrow,—though this does not play the important part assigned to it by M. Serres, Brachet, and Segalas,—in which the central organ and its motor nerves, to the exclusion of the excitors, are involved. The state of the circulation affects all the motor organs under the control of the spinal marrow; and they act with increased energy when the circulation is either plethoric or anæmic, though in the latter, exhaustion of the nervous energy quickly ensues. Thus, there is one puerperal convulsion of hæmorrhage, when the heart and bloodvessels have been drained of blood, and another, of fulness of the circulation. Want and excess of blood, or materies morbi in the circulation, act as direct stimuli to the spinal centre, and thus the state of the circulation materially affects the uterus during labour. There are also certain agents of the materia medica, which, taken into the circulation, affect the spinal marrow. Thus, the ergot of rye, passing into the blood, affects the uterus by a direct spinal action; so does strychnia, so does the inhalation of carbonic acid, and so, I believe, does ipecacuan—the influence of which in producing uterine contraction is very remarkable. Savine, aloes, alcohol, and the biborate of soda, may probably be added to the same list.

The *Peristaltic* or *Immediate* action of the uterus still remains to be considered.

All muscles contract when subjected to immediate irritation, after they have been cut off from the influence of the cerebral and spinal centres, and when they have been as far as possible deprived of their nerves. In the case of muscles supplied by cerebral or spinal nerves, the contraction is limited to the spot irritated, and ceases with the removal of the irritation, but in organs partly or wholly supplied by ganglionic nerves, as the heart, bladder, intestines, œsophagus, &c., the motion produced is of a Peristaltic kind, spreading, generally in a vermicular manner, to a distance from the point of irritation, and continuing for some time after the irritation has ceased. The uterus is eminently endowed with this form of contraction. When one point of the uterus is stimulated through the abdominal parietes, the contraction excited extends with the utmost rapidity to the whole organ; the same occurs when the fingers are made to irritate any point of the internal surface of the uterus. Harvey beautifully described this peristaltic form of action in the uterus of the doe; William Hunter saw it in the cat and the rabbit; Professor Müller, in the uterus of the rat and the oviduct of the turtle; I have seen the same thing in the uterus of the guinea-pig and other animals. This form of motor action is the basis of the other uterine actions. In natural labour in the human female, it is, so to say, disguised by the reflex actions, but under certain circumstances it is able to effect, unaided, the expulsion of the child. In paraplegia from disease of the lower spinal marrow, where volition, emotion, and reflex action are entirely withdrawn, the immediate action of the uterus, or that depending on muscular irritability, and the ganglionic system, is the only form of motion remaining to the uterus. Such a case is recorded by M. Brachet, in which the uterus contracted, though with extreme inertia. Patients in this state, and animals reduced to this condition by experiment, have been delivered by the stimulus of galvanism applied to the uterus itself. When cut off from the spinal centre, the uterus requires the stimulus of galvanism or some external irritation to excite it to contraction. Cases are on record, in which labour having commenced during life, delivery has been effected without mechanical assistance, after the death of the mother. For instance, a case is related, in which a woman dying during delivery was placed in a coffin, and the child was found wholly expelled, between the thighs of the dead mother, on the following day. Similar cases are on record, both in ancient and modern authors. Dr. Robert Lee has informed me of a remarkable, and I believe unique case, in which the uterus was completely inverted after death. The patient had died suddenly; and twenty-four hours afterward, on proceeding to make an examination, the uterus was found external to the vagina, (it had been ruptured, which was the cause of death,) and the fœtus remained in the abdominal cavity. The solution of these extraordinary phenomena, though it has not hitherto been given, does not seem very difficult. A slow reflex action of the uterus may possibly continue long after the rhythmic respiratory movements have ceased, as long, indeed, as the body retains its warmth. But we know that the heart, œsophagus, and intestines, may be excited to peristaltic action after death ; violent peristaltic action is often a part of the act of dying; and I am of opinion, that in the human uterus, it is peristaltic action chiefly which expels the child when the mother has died during labour undelivered. There is, however, another source of post-mortem muscular contraction, which I believe has never been referred to in the case of the uterus—this is, the post-mortem muscular spasm. We know that in the case of an analogous organ—the heart, the rigor mortis occurs to such an extent as to empty the ventricles of blood, and even to simulate concentric hypertrophy. The extrication of gases by decomposition in the abdomen, the explanation usually adopted, is not sufficient to account for the expulsion of the fœtus after death, and certainly not enough to explain the complete inversion of the uterus, as in Dr. Robert Lee's case. The rigor mortis, therefore, ought to be considered as another cause of post-mortem delivery.

The direction taken by the peristaltic action is of considerable importance. Professor Müller, Michaelis, and Wigand, teach that uterine contraction commences at the cervix, and travels towards the fundus, returning thence towards the os uteri. This is thought by Michaelis to prevent prolapsus of the umbilical cord, and the descent of the arms of the fœtus before the head; the cord and the arm, when lying low in the uterus, being swept upwards, beyond the risk of danger, at the commencement of every pain. Wigand considers the direction of the contraction to be proved by the phenomena attending a labour-pain. At first the os uteri grows tense, the head or presenting part recedes from the touch, and the bladder of membranes protrudes; after this, the fundus uteri becomes hard, and the presenting part of the child begins to advance. I believe this view of Wigand, which has been particularly insisted upon by Dr. Rigby, to be a close inference from the facts which any one may observe; Professor Murphy, however, considers it altogether incorrect, and attempts to controvert it. This eminent accoucheur, who may be said to have completed what has been termed the mechanism of parturition, commenced by Sir Fielding Oulde in the school in which Dr. Murphy was formed, believes the fundus uteri to be the first in the order of contraction. He states, in support of his opinion, that if after delivery the hand be introduced into the uterus, the organ may be felt to contract on the withdrawal of the hand, the contraction commencing at the fundus, and then travelling downwards. The rest of the argument of Dr. Murphy is contained in the following passage:— .

"If we desired an additional evidence to prove that the fundus was the first to contract, and not the os uteri, we could not have a stronger proof than that advanced by Wigand to support a contrary opinion—viz., the head, when the contractions commence, getting 'even out of the reach of the fingers whilst the os uteri is filled with the bladder of membranes.' In Wigand's explanation, the influence of fluid pressure seems to be altogether forgotten. The immediate effect of contraction commencing at the fundus would be to compress the liquor amnii, which of necessity forces its way before the head, on to the mouth of the uterus. The fluid, in this position, reacts against the head with the same power that it is compressed, and therefore pushes it up until the increasing contraction of the fundus forces the head down again, so that you perceive the phenomena quoted are quite consistent with the statement, that uterine contraction begins at the fundus; in fact, it could not be otherwise, so long as the waters remain in the uterus. But if the contraction commenced from below, the fluid must be driven upwards towards the fundus, and that portion between the os uteri and head pressed aside, at least in the first instance, so that the head might be easily felt when the pain commences, although not so afterwards; but the reverse is the case, and you will find, that in those cases where the liquor amnii is in large quantity, that it is difficult to feel the head at all, except in the interval of the pains."

To this it may be objected that it is Dr. Murphy who has forgotten "the influence of fluid pressure." He imagines that by contraction of the lower part of the uterus, the amniotic fluid would be "driven upwards towards the fundus;" but it must be remembered that the uterus is a hollow muscle already accurately filled, the only outlet being at the os uteri; and pressure exerted at any part of the uterus, cervix, or fundus, can have but one immediate effect—namely, to protrude the membranes at the os uteri, no other part of the uterus, in fact, being able to yield. The contents of the uterus are not compressible, so that any contraction or diminution in its capacity must be represented by some protrusion at the os uteri; either this or rupture of the uterus must take place. The fluid could only pass towards the fundus uteri by displacing the solid contents of the uterus, and protruding the head. It is a well-known law in hydrostatics, that when fluid is subjected to compression, the effect is equally diffused through the whole mass, and is felt alike in all directions. Pressure upon the os uteri and cervix uteri, in contractions of this part, does not affect that portion of fluid contained in the cervix more than that in the fundus. Pressure applied at any part of the uterus would as inevitably protrude, in the first instance, the membranes through the open os uteri, as that pressure on any part of a bladder of water with a hole in the neck would expel the fluid. It would not matter whether the pressure were exerted close to the aperture or at the fundus of the bladder. Thus, then, this part of the argument of Dr. Murphy falls to the ground. The protrusion of the amniotic bag at the commencement of a pain, is no indication that pressure is applied either at the cervix or fundus, but simply that pressure is somewhere applied. The direction of the pressure must be argued from other considerations.

Neither is it correct to say, that fluid pressure coming from the fundus would react against the head of the fœtus at the cervix. The recession, more apparent than real, of the head at the commencement of a pain is undoubtedly in favour of the view of Wigand. A solid body, such as the fœtus, might be moved in a fluid medium by solid pressure applied at any particular part; and the contraction commencing at the cervix, the uterus comes into immediate contact with the head, and moves it in the fluid medium, as it is moved upwards in the ballottement; the fluid must present by just so much as the uterine cavity had been diminished by the contraction, and it would be only when the fundus contracted, so as to come into contact with the solid fœtus, that the head would descend and displace the waters.

If, as is most probable, the peristaltic action of the uterus does take this course, it is not singular, for, according to the observations of Magendie, the contents of the stomach are, during digestion, passed through the pylorus by a peristaltic movement, which begins at the pylorus, proceeds to the cardia, and then sweeps back again from left to right. Müller also describes the contraction of the heart of the frog as commencing in the venous trunks; then descending, in succession, to the auricles and ventricles; and then affecting the bulbus aortæ. The peristaltic action commences at the auricle, travels to the apex, and then returns towards the base of the ventricle. There seems very excellent reasons for the commencement of the peristaltic action at the cervix in the human subject, in the necessity which exists for some provision against prolapsus of the cord, and arm-presentations; and still more, from the great probability that, if contractions commenced at the fundus uteri, inversion of the organ would be frequent. I am persuaded that inversio uteri is not, as is so generally supposed, a mechanical accident, dependent on shortness of the cord, or injudicious traction of the placenta; but that it is really a kind of intus-susceptio. The fundus contracts by itself, and descends into the body of the uterus, so as to be grasped by the sides of the organ, when it is forced downwards, and thus completely inverted. It is worthy of note, that the fact recorded by Dr. Murphy, relative to the descent of the uterine contraction from the fundus, on the introduction of the hand after delivery, hardly applies to the progress of natural labour, though it does apply very closely to the subject of inversio uteri. The uterus may not act in the same way when empty as when containing the fœtus, and the hand of the accoucheur is neither the natural stimulus of the organ, nor applied in the natural way. It is very difficult, too, for the touch alone to be certain on such a point as the direction of uterine contraction. All we can say with certainty is, that very nearly at the same instant that the orificial circle of the uterus becomes tense and dilated, the fundus is felt to contract forcibly. Whenever the contraction commences, it spreads over the whole organ with great rapidity. I have often endeavoured, by the taxis, during labour, both at the os uteri, and through the walls of the abdomen, to trace the direction of the uterine contractions, but have not been able to do so satisfactorily. Where the abdominal walls have been very lax, I have felt the organ, at each pain, erect itself as it were, and stand out against the abdomen so firmly as not to admit of its being moved. The peristaltic action might be observed, perhaps, in a patient greatly emaciated, or it would be easy to ascertain the matter, if a pain could be watched during the Cæsarian section. At present, the evidence we possess is strongly in favour of Wigand, or at all events, his opinions are not affected by Professor Murphy's argument. But whatever the direction of the uterine contractions, there can be no doubt of their peristaltic form; many of the accidents of midwifery, such as hour-glass contraction, inversion of the uterus, and post-mortem delivery, can only be explained after this manner.

I have now to treat of the motor powers concerned in the *Dilatation* of the os uteri during labour.

In addition to the divers forms of uterine contraction, there is the Dilatation of the os and cervix uteri to be considered. I have not treated of the muscular structure of the uterus by which all these actions are accomplished, my present purpose being with physiology rather than anatomy, and the muscularity of the uterus being a generally acknowledged fact.

But in the case of the os uteri considerable discrepancy of opinion exists. Nothing like a complete muscular ring, such as is found to compose the other sphincters, has been made out in the os uteri. The cervix uteri, however, according to Jobert and other anatomists, contains numerous semicircular fibres arranged round it, and the sphincteric action of the uterus is not confined to the os uteri, but extends to the cervix also. In these two parts, taken together, there is quite enough contractile fibre to account for all the motor phenomena they display. The os and cervix are composed of mixed contractile fibre and elastic contractile tissue. United, this tissue acts as an imperfect sphincter, dilatable partly by the mechanical force exerted by the contraction of the rest of the organ, and the protrusion of the liquor amnii or the fœtal head; and partly by an active sphincteric power. In so far as it is composed of elastic tissue non-contractile in its character, it dilates simply from mechanical distention; while, inasmuch as it consists of contractile fibres, it has the power of active, positive, dilatation and contraction, as a nervimotor organ.

I have told you that the muscular fibres of the os and cervix uteri are only semicircular. There is, indeed, an obvious reason why the complete circular muscle, sought for in vain by William Hunter and Sir Charles Bell, should not exist in this situation. Before the commencement of labour in primiparæ, the os uteri is quite closed; while in parturition it is dilated to such an extent as to permit the passage of the fœtal head—a mass whose shortest diameter is three inches and a half, making the line of the circle necessary for its passage nearly eleven inches. This is a dilatation far exceeding that required in the actions of any of the recognised sphincters, and we cannot but conceive that if completely circular fibres existed at the os uteri, rupture of the circle would be inevitable. On the other hand, if there were no contractile fibres, but merely elastic tissue, subject only to mechanical distention, it would be impossible to account for that sudden contraction of the os uteri which often takes place after many hours of dilatation, immediately on the conclusion of labour, and but for which fatal results would be inevitable in cases of implantation of the placenta over the os and cervix. Thus the combination of semicircular muscular fibres and elastic tissue is admirably adapted for the mixed dilatation and distention required of the os uteri in parturition, and also for its subsequent contraction.

These observations, of course, only apply to the era of parturition. It is not meant that during gestation the os and cervix act as a sphincter, and so shut up the fœtus in the uterine cavity. The motor powers of the uterus, whether of the os or fundus, of dilatation or contraction, remain—except, as we shall see hereafter, the peristaltic action—comparatively inert, until these powers are suddenly evoked for the performance of labour.

Some of the physiological proofs of the possession of dilatile and contractile powers by the os and cervix uteri may be enumerated, and these proofs are not less convincing than the most certain anatomical evidence. In the first place, if the semicircular fibres of the cervix contracted with the same force as the fibres in the rest of the uterus, this organ could scarcely be emptied of its contents. Doubtless the contractions of the body and fundus uteri are strong, their bearing upon the cervix powerful, and the amniotic bag admirably adapted for mechanical distention; but it must be remembered that the short fibres of the cervix act at a great mechanical advantage, as compared with the fibres in any other district of the uterus. Let any one who supposes the body and the fundus may forcibly overcome a contracted state of the os and cervix, consider that the united power of all the respiratory muscles is insufficient to force the small muscles which close the glottis. The nature of the hæmorrhage in placenta prævia, as compared with hæmorrhage from the fundus, affords a strong argument in favour of a positive dilatation of the os uteri. In hæmorrhage from the fundus, the loss of blood is arrested during a pain, because the fundus is in a state of contraction; in hæmorrhage from the os and cervix, the flow is increased at each return of the pains, because the cervix is in a state of dilatation. If the dilatation were merely a mechanical distention, the pressure which dilated the os uteri might be expected to arrest the hæmorrhage at the same time.

Owing to the mixed mechanical and muscular dilatation of the os uteri, it generally opens slowly; cases however occur in which, after long-continued rigidity, it dilates so suddenly, that even from this fact alone it is difficult to consider it a mere mechanical distention, the resiliency of the part affecting its subsequent contraction. But the strongest physiological proof of the existence of muscular power in the os and cervix uteri, is the forcible contraction which sometimes occurs after full dilatation—as, for instance, in cases of encysted placenta, in which the fingers can only be introduced with the greatest difficulty; and again, in inversio uteri, where the speedy and powerful contraction of the cervix is one of the elements of the accidents most opposed to the re-position of the organ.

Both as regards structure and function, the os and cervix uteri are, at the time of parturition, comparable to the pylorus. The pylorus, like the os uteri, is formed by a duplicature of the fibrous and mucous coats. But for this duplication, the stomach and duodenum, and the uterus and vagina, would form two continuous tubes. If we could suppose the pylorus projecting into the duodenum, the outward anatomical resemblance between the two would be perfect. In labour, the duplicature which causes the projection of the os uteri into the vagina is not only dilated, but, as it were, unfolded, and the uterus and the vagina become almost one smooth continuous canal, like the stomach and duodenum when the pylorus dilates. Another sphincter, the cardia, has the power of dilatation to comparatively as great an extent as the os uteri; the cardia of the owl, for instance, dilates to such an extent as to admit a small bird or a mouse entire. The enormous distention of the entire upper part of the alimentary canal in serpents is well known. Tho uterine and digestive systems admit also of a more general comparison. There is analogy between the fimbria of the Fallopian tubes and the mouth and pharynx; between the Fallopian tubes themselves and the œsophagus; we may compare the circular muscles at the entrance of the Fallopian tubes into the uterus with the cardia, the uterus itself with the stomach, and the os and cervix, as I have already said, may be compared with the pyloric orifice.

The contractile and dilatile power of the os and cervix, like that of the sphincter of the cardia, is chiefly regulated by reflex spinal action, but it seems to be altogether removed from the direct influence of volition. The sphincters are all remarkable for the property of reflex dilatation as well as reflex contraction; of a positive dilatation excited in a reflex form. The relations of the different sphincters to each other are most singular and interesting. In this place, a few instances of the reflex spinal connexion between the different sphincters will be sufficient, as in treating of the acts of parturition and rigidity of the os uteri, I shall have to speak of the subject more fully.

In the act of swallowing, the cardia dilates, and the glottis closes accurately, to prevent the entrance of particles into the larynx; in vomiting, the cardia is also open, and the glottis closed. In defecation, the dilatation of the sphincter ani causes the sphincter vesicæ to dilate. In dilatation of the constrictor vaginæ, both the sphincter ani and sphincter vesicæ dilate, and there is simultaneous relaxation of the glottis. The play of reflex action among the sphincters is altogether, in health or disease, a most interesting topic. Singular to say, Dr. Todd, overlooking numerous facts to the contrary, denies the reflex action of the sphincteric muscles. It is our duty, not only to endeavour to set forth the truth clearly, but to anticipate objections. It may, perhaps, be argued, that the consentaneous action of the different sphincters takes place simply from mechanical pressure; that the same pressure which evacuates the rectum, empties the bladder. The answer is simple—in vomiting, for instance, an immense pressure is exerted on the open cardia, yet the glottis is firmly closed.

For the performance of all the acts of ingestion and egestion, the thorax, abdominal cavity, and pelvis, may be looked on as forming one cylindrical cavity, supplied with a number of stops, which close and open with admirable accuracy under the control of the nervi-motor apparatus, presiding over the various acts of ingestion and retention, egestion and exclusion. This is, in fact, one great function of the true spinal marrow, and its excitor and motor nerves. The materials for ingestion and egestion, by their physical qualities alone, independently of sensation, supply, when brought into contact with the ingestive and egestive tubes, the necessary stimulus to the excitor spinal nerves, whereupon all the necessary motor phenomena, both of contraction and dilatation, occur with the nicest regularity, and the most perfect aptitude for the functions to be performed.

Such are the various forms of motor action belonging to the uterus, and brought into play at the time of parturition. Volition may be said to affect the process only indirectly. Emotion has a direct influence, but it is accessory rather than essential to its performance. Reflex action is the great physiological power, which being absent, the function of parturition could not be properly performed. Peristaltic or Immediate action is the basic or radical element upon which the other causes of motor action operate. Here, as in other instances, "Knowledge is power;" to know the various sources and modes of motor action is almost equivalent to the ability to guide and control their impulses.

Delivery may be effected under a variety of circumstances, and we may consider every new condition in which there is a departure from the natural method as in reality an experiment offered by Nature, and of use in the illustration of normal parturition. Delivery may take place in cerebral paralysis, in which volition only is withdrawn—the influence of emotion, all the reflex motor actions, and the peristaltic action of the uterus, remaining. It may occur in profound coma, where volition and emotion are both withdrawn, all the reflex and the peristaltic actions being present. It may also be effected in paraplegia, from disease in the middle portions of the spinal marrow, in which volition, emotion, and the respiratory reflex actions, are cut off; the reflex actions of the uterus itself, and the peristaltic action of the organ, only remaining. It will hardly take place except in rare instances, but it may be excited, as by electricity, even in cases of paraplegia from disease affecting the lower segments of the spinal marrow, where volition, emotion, and the reflex actions, uterine and extra-uterine, are removed, and where peristaltic action exists alone. It may even, as we have seen, take place at the moment of death, or some hours after dissolution, when it may be excited by the spasm of death itself; by reflex actions continued after death; by the rigor mortis—this peculiar condition affecting the uterus in common with the heart and other muscles; by the peristaltic action continued after death; or by all these actions combined. But putting aside everything save the post-mortem spasm, it is no more wonderful for the uterus to contract and expel its contents after death, than it is for the heart to contract to such a degree as to empty its cavity; for the œsophagus of a rabbit to swallow food; for the œsophagus and cardia of the human subject to expel flatus, as I have seen happen; or for the intestines to contract violently after death—facts, all of which have been repeatedly observed. The excessive action of the uterus before death probably increases its tendency to contract after death. It has been observed, that after death from Asiatic cholera and fevers attended by spasmodic actions, the post-mortem contractility of the muscles is remarkably increased.

These different conditions under which the expulsion of the fœtus may take place in health, disease, or even after dissolution, afford in themselves a very admirable analysis and synthesis of the various motor powers by which natural parturition is performed. So far, however, from being used in this manner, such facts have hitherto only been made a source of confusion, and the occurrence of delivery in hemiplegia, paraplegia, and after death, has been thought to afford positive and conclusive proof that the uterus is in natural parturition altogether independent of the nervous centres.

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LECTURE IV.

NERVI-MOTOR ACTIONS OF THE FALLOPIAN TUBES IN MENSTRUATION, COÏTUS, CONCEPTION, AND PARTURITION.—NERVI-MOTOR ACTIONS OF THE VAGINA IN THE UNIMPREGNATED AND PARTURIENT STATES.

Impregnation, uterine oviposition, or the conduction of the ovule from the ovarium to the uterus, and, finally, parturition, are all effected by means of certain motor principles of the female economy. You will find the study of the motor phenomena of those functions tends very much to their mutual elucidation, for, strictly considered, they are only so many different yet allied actions of one and the same motor apparatus. I shall show you plainly, as we proceed, how the intimate but hitherto unperceived relations which exist between menstruation, impregnation, and gestation, may be made of the greatest use in detecting the nature of the more mysterious phenomena of parturition. The Ovaria, Fallopian tubes, Uterus, and Vagina, form in the aggregate the sexual canal, the machinery in and by means of which this entire series of functions are performed; and we shall fall very short of understanding them, unless we study, separately and collectively, *all* the motor actions of the different parts of this apparatus, in *all* the functions of the generative system. In deciphering the physiology of parturition, it is as necessary to study the nervi-motor endowments of the vagina and Fallopian tubes, as those of the uterus itself; as important to examine menstruation and conception, as to investigate the act of labour. In the preceding lecture, I have directed your attention to the nervimotor actions of the uterus, but the motor actions of the vagina and Fallopian tubes still remain to be studied. Taken together with the uterus, they may be considered the development of the simple tubular oviduct of the lower animals; and, in many points of view, we may look on these parts as forming one continuous canal for the reception and transmission of the ovule from the ovary to the uterus, and the expulsion of the ovum from the uterus at childbirth. The Fallopian tubes are the organs of oviposition; the uterus and vagina are the organs of gestation and parturition. The vagina is, moreover, the primary organ for the ingestion of semen. Let me first speak of the Fallopian tubes, the ovipositors of the human female and of mammalia in general.

The Fallopian tubes, like the intestinal canal, possesses two sets of muscular fibres—a circular and a longitudinal; and their action is also *Peristaltic* in form. In fleshy subjects the muscular fibres of these tubes are readily made out, but in others they are sometimes difficult to trace. In cases of tubarian pregnancy, the muscular structure becomes very evident, and increases with the growth of the ovum, till it reaches a very considerable thickness. Both before and after conception, they have been seen in the rabbit, by Cruickshank and other anatomists, firmly embracing the ovaria, and in a state of strong vermicular action. By this action the impregnated ovule, when detached from the ovarium, is conveyed into the cavity of the uterus. The Fallopian tubes have also been seen clinging to the ovaria, in the lower animals, during the period of œstruation, where no congress with the male had been effected. In women who had died during menstruation, the same thing was observed by M. Gendrin. The Fallopian tubes were found firmly applied to the ovaria. Here, the office of the tube must be to conduct the unimpregnated ovule from the ovary to the uterus. M. Gendrin insists on dilatation and injection of the Fallopian tubes, and the application of their dilated extremities to the ovaria, as constant and special conditions of menstruation.

Besides the strictly motor phenomena of the Fallopian tubes, these tubes become so turgid under stimuli, as almost to deserve to rank with the *Erectile* organs. In the experiments of Cruickshank upon rabbits, the fimbriæ were black from excess of blood; and in a preparation in the museum of St. George's Hospital, this injected and erectile state of the tubes is shown in great perfection.

It is also probable that in simple coïtus the same action of the Fallopian tubes occurs; that at the instant of the orgasm, they erect themselves, and contract upon the ovaria. The human female is considered passive both by Professor Müller and Dr. Carpenter; but the sexual orgasm of the female was fully recognised by John Hunter, as a passage from one of his papers on the Animal Œconomy will show:— "There is," he says, "one part common to both the male and female organs of generation, in all animals which have the sexes distinct: in the one, it is called the penis, in the other, the clitoris. Its specific use in both is to continue, by its sensibility, the action excited in coition, till the paroxysm alters the sensation." This paroxysm in the female may be attended by an action of the Fallopian tubes similar in kind to that affecting the ejaculatores muscles and the bulb of the urethra. At all events, it is extremely probable that during coïtus contractions of the tubes upon the ovaria take place. It is true that no sensations are referred to the tubes themselves during coïtus; but neither are the vesiculæ seminales sensitive during the contractions of these organs in the male. Some of the older anatomists—Whytt and others—implicitly believed in this contraction of the Fallopian tubes during coïtus.

The physiology of *Coïtus* is a subject very little understood, some eminent names denying, as we have seen, any orgasm to the female, while others imagine that this orgasm is necessary to conception. But neither of these positions are really correct. Sensation and emotion are super-imposed upon conception, doubtless for wise and provident purposes; but they are bestowed rather as incitements to fecundity, than as conditions absolutely essential to the propagation of the species. Strip the function of reproduction of all that is sensational and emotional, take away the psychical, leaving only the physical, and still propagation is not necessarily arrested. This is irrefragably proved by the fact, that fecundity remains, notwithstanding the annihilation of sensation, and the emotions dependent upon local excitement, by paraplegia. These points are of evident importance in the comprehension and treatment of sterility. Impotence and sterility are both of them disorders to which the human female is liable. I would limit the term impotence in women, to failure in the production of the sexual orgasm; sterility, to failure either in the maturation of the ovule, impregnation, or the process of oviposition. Paradoxical as it may seem, a woman may be fertile, but yet impotent; or she may be impotent, and yet conceive and bring forth children. Women to whom the term "frigida" is applicable, but who have become mothers, are referred to by Heberden. These facts are well conveyed in the following passage from this eminent physician:—"Duo mariti mihi narrarunt uxores suas in venerem fuisse frigidas, omni ejus cupiditate et voluptate carentes; sæpe tamen gravidas factas esse et recte peperisse." Such a state of things, which may be a source of great marital unhappiness and disappointment, is not uncommon, particularly in women of chaste minds, who have not entered upon married life till after the season of youth. Of course, this frigidity may be either positive or relative; it may depend altogether upon the female, or the imperfection may be on the side of the male. Harvey explicitly notices the fact, that many women in the married state habitually conceive in the absence of all sexual sensation. Permeability, and unerring motor action of the Fallopian tubes, are conditions positively essential to healthy impregnation and conception; and to this portion of the sexual canal we must look for the cause of sterility in a considerable proportion of cases. Occlusion, displacement, or inactivity of these tubes must inevitably lead to sterility or extra-uterine pregnancy.

The form of action of the Fallopian tubes has been shown to be peristaltic, but it comes to be a question whether those tubes can be excited to *Reflex* action. Now, they contract, and apply themselves to the ovaria before they have received the ovule; and there is no direct nervous communication between the ovaria and the Fallopian tubes sufficient to account for any direct excitation of the tubes by the ovaria. Like every other action of a similar kind with which we are acquainted, the action of the Fallopian tubes is doubtless reflex and spinal, and the ovaria must be the chief excitors of their reflex actions. This is the case in œstruation, menstruation, and conception; but if the fimbriæ embrace the ovaria in coïtus, it is probable that the nerves of the vagina are also excitors of this reflex action. In the whole range of reflex action, or, indeed, of physiology, there is nothing more extraordinary than the reflex action of the Fallopian tubes from ovarian excitation. There seems a positive instinct, a power of selection, in the exactitude with which their fimbriated extremities find out and embrace the ovaries, but for which, extra-uterine fœtation, with its great dangers, would be very frequent. In this internal embrace, the most perfect adaptation occurs, in the total absence of sensation and volition. Many minds have felt a difficulty in receiving the doctrine of the independent and insentient action of the true spinal marrow, and its excitor and motor nerves, because of the extraordinary adaptation and appearance of design sometimes observed after decapitation or decerebration, being fain to consider such adaptation a proof of the presence of design and will, in the spinal marrow itself. Here, in the case of the Fallopian tubes, there can be no suspicion of volition, and yet the motions of these muscular tubes are so unerring in their power of embracing the ovaria, and of not seizing the intestines or the abdominal parietes, as quite to equal any of those actions which have been supposed to be emotional or voluntary in decapitated animals.

Thus, then, the motor endowments of the Fallopian tubes are, like those of the œsophagus, both *peristaltic* and *reflex*. I have referred to the erection of the Fallopian tubes. This erection is insentient. Women are not conscious of the erection and embrace of the ovaria during menstruation, nor, indeed, during coïtus. In menstruation particularly, this erection is not preceded or attended by sensation, so that here it cannot, as in the case of the male, be partly emotional; it must, like the erection of the penis in paraplegia, be reflex. This erection of the Fallopian tubes is probably of great use in *directing* the tubes and their fimbriæ towards the ovaria. A study of the anatomical relation of the tubes to the uterus, ovaria, and broad ligaments, strengthens this probability. Still, notwithstanding the aiding power of an erectile state of the tube itself, the accurate grasp of the ovary at the precise point by the loose and floating morsus diaboli, is not the less wonderful.

Many years ago, Dr. Marshall Hall, after describing erection and emissio seminis as reflex in their nature, observed, "That the grasp of the Fallopian tubes is excited on the same principle is extremely probable;" and again he remarked, "Of all the facts in physiology and pathology, the nature of conception and the causes of sterility are, perhaps, the most obscure. Excito-motor in its nature, conception involves the ingestion of the semen, and the grasping of the ovum." I quote these passages for their own importance, and for the sake of bringing them to bear on an objection which has recently been urged against them. I refer again to the article on the nervous system in the Cyclopædia of Anatomy, to which I have alluded in former lectures: Dr. Todd, the author, rejects the reflex action of the tubes in coïtus and conception. He says,—"In conception, or what Dr. Hall calls the ingestion of semen, I am at a loss to conceive what reflex act can occur. The grasping of the ovary by the extremity of the Fallopian tube is more likely to be an act of emotion, due to the general sexual excitement, than a reflex phenomenon, excited by the stimulus of coition." I submit that the answer to Dr. Todd's own explanation of these phenomena is clear and decisive. Conception may take place in coma, insensibility, the cataleptic trance, or even in women perfectly paraplegic. In none of these cases can the grasp of the ovaria by the Fallopian tubes be referred to the emotional excitement of coïtus. It is quite possible for women to conceive under other circumstances, not only without sexual excitement, but where feelings of an opposite character are present, as in cases of rape or violence. Besides, the Fallopian tubes, as we have seen, grasp the ovaria on other occasions than coïtus, as in menstruation &c. There must therefore be some other source of motor action in these tubes besides emotion and sexual excitement. Of the really reflex nature of this action it is impossible to doubt unless a great body of convincing facts relating to the subject are entirely overlooked. But to overturn Dr. Todd's hypothesis, one fact is sufficient,—namely, the grasp of the Fallopian tubes and conception in women suffering from paraplegia, where the act of coïtus is altogether devoid of sexual sensation and excitement, and where emotion is cut off from the organs concerned. In expressing myself thus, I do not mean to deny that emotion may, during coïtus, contribute to the contractions of the Fallopian tubes, but what I would insist on is this; we must separate coïtus from conception: and the facts I have cited prove that there must be another and a more general cause exciting these tubes to action, quite independently of sensation and emotion.

At the point of the junction of the Fallopian tubes with the uterus, the internal area of the tubes is considerably diminished; there is a condensation of the muscular fibre in this situation, and on the internal surface of the fully-developed gravid uterus, two large circular muscles, described by Ruysch, are visible—Fallopian sphincters, as they might be termed. I have already drawn an analogy between the cardia and the uterine extremities of the Fallopian tubes, as the superior orifices of the uterus and stomach respectively. The anatomical structure of the two organs is similar, and though it would be difficult to determine the point with certainty, it is not improbable that sphincteric contraction and dilatation may occur at the utero-Fallopian apertures during the ingestion of the ovule into the uterus. During the passage of the ovule, the simple dilatation of the Fallopian tube is very marked. I dwell on these points, for my wish is to make the ingestion of the ovule as clear to you as deglutition, or any other ingestive act.

The condition of the Fallopian tubes during Parturition is an interesting subject of inquiry. The relative position of the uterus, the broad ligaments, the tubes and the ovaria, are considerably altered by the development of the uterus during gestation; but still the fimbriæ remain within reach of the ovarium; and it is very probable, that during parturition, the tubes are active, and applied to the ovaria in the same manner as in menstruation and conception. You will see hereafter, from evidence derived from the phenomena of parturition in the lower animals, that it is very difficult to reject this view of the action of the tubes in parturition.

There is one peculiarity in the action of the Fallopian tubes which is of considerable importance. In simple coïtus, any contraction which occurs is probably of a transient nature; there is the temporary stimulus and the temporary action; but in menstruation, œstruation, and conception, the contraction is persistent, remaining for a considerable period: the stimulus and the action are both continued. This persistence distinguishes it from ordinary reflex action in the human economy, and allies it in its nature to the contraction of the fore limbs of the male frog, and the extension of the fore limbs of the female frog, during their prolonged coïtus and oviposition, which continues for several weeks. At the first glance, this may seem a far-reaching analogy; but you will see, as I proceed, that I shall be quite able to justify it. The tendency to this persistent contraction is periodic. In the unimpregnated human female, the stimulus returns every lunar month; in the frog, only once a year.

The Fallopian tubes, then, are organs of periodic function during a certain portion of female life. They are the ovipositors of mammiferous animals during the fertile eras. In the human female, during infancy and childhood, until the development of these tubes, they remain, together with the other parts of the generative system at puberty, quiet and inactive. But after puberty, roused, like so many other portions of the female economy, they are probably brought into energetic action during coïtus, menstruation, conception, and parturition; but most certainly during menstruation and conception, the action being transient in coïtus, and persistent in menstruation and conception. In menstruation, conception, and parturition, the ovarian nerves are the excitors of the reflex and insentient contractions of the tubes; but if they erect themselves and contract upon the ovaria during coïtus, the nerves distributed to the erectile tissue of the vagina must act as additional excitor nerves. For the present I must dismiss this part of our subject; when I come to speak of the cause of labour I shall have to refer to the functions of the Fallopian tubes again. I hope I may observe, without justly incurring the charge of egotism, that although many of the points now brought under your notice have been referred to and dwelt upon before, still they have not hitherto been grouped together in a consistent and logical manner, so as to bring out their real physiological meaning.

I have next to speak of the motor actions of the Vagina.

The chief outlets of the mucous cavities, except the vagina, are guarded at the orifices by sphincters. The constrictor vaginæ, at the entrance of this canal, represents the sphincters found in other situations. It is a thin, small muscle, not perfectly orbicular. A perfect sphincter in such a situation would indeed be out of place, owing to the immense dilatation required of the vagina in childbirth. An ordinary sphincter, if it existed, must far exceed the sphincter ani in size. When labour comes to be treated of, it will be seen how a sphincteric muscle in this situation is compensated for, and how well the actual arrangement contributes to the safe expulsion of the fœtus. The cellulo-fibrous sheath immediately surrounding the mucous membrane of the vagina is an extension of the fibrous tissue of the uterus itself. I have already said that the os uteri is formed, like the pylorus, by a re-duplication of the mucous and contractile tunics, only this mode of formation is more exaggerated in the os uteri than in the gastric sphincter. In labour, the process of dilatation causes the almost entire obliteration of the os uteri, and the uterus and vagina become, as it were, one uninterrupted canal. The vagina, and particularly the upper portion, enlarges in size during the latter months of pregnancy. A real growth of the fibrous or muscular sheath, similar to the growth of the muscular tissue of the uterus, with which it is continuous, takes place, though in a less degree. We know that during the early months there is some contraction, but in the later months an enlargement, and even protrusion, of the vagina; and during labour, not only is the diameter increased, but the length of the vaginal canal becomes greater. This could hardly exist, without an actual increase of size.

In the unimpregnated state, a slight, *Voluntary* power may be exerted over the constrictor vaginæ, and apparently over the muscular sheath, particularly at its lower portion. Women have some voluntary power of expelling matters from the vagina—as, for instance, the menstrual secretion, particularly where coagula are passed, by a slight, voluntary contraction of this organ, aided by the action of the abdominal muscles.

The vagina, in the unimpregnated state, has also a *Reflex* action. This is evident when the canal is distended by a polypus, or a tumour of any kind; in some cases it is very marked. On the introduction of the speculum, the vagina grasps the instrument very firmly, and without any exertion of the will.

There is no sign of the presence of *Peristaltic* action in the vagina. We may observe, that it is in the distal and most simple portion of the human oviduct that the peristaltic form of action is most marked — namely, in the Fallopian tubes, but as we approach the outlet, the peristaltic action becomes less marked, while the influence of volition and sensation appear, as if by way of compensation.

The *Dilatation* of the vagina is an important function of this organ; it occurs at its upper portion, before the fœtal head has passed through the vagina, and it is therefore not simply a dilatation by distention; the undoubted presence, too, of contractile fibres in the vagina, renders the idea of a simple relaxation impossible. The dilatation must be of the same mixed kind as that of the os and cervix uteri. It is one part of the concatenation of events by which delivery is accomplished. At the same time that active contractions are going on at the fundus and body of the uterus, a positive muscular dilatation is taking place in the passages through which the fœtus has to be expelled. When the propulsive stage of labour has commenced, and the expiratory muscles are acting forcibly, the dilatation of the vagina is increased by the effects of mechanical pressure. To this point I shall have to revert hereafter. The dilatation commences at the os uteri, and gradually proceeds downwards to the vagina, but in its whole course it distinctly precedes the mechanical pressure of the child upon the parts. Even the perinæum is in some degree dilated before it comes to be distended.

Such is the nature of the succession of stimuli to action provided in parturition, that the *Contraction* of the vagina in labour does not commence until after the full point of dilatation has been reached. When this is the case, and the fœtus has fairly engaged the vagina, the whole parturient canal becomes contractile, and the cervix uteri and vagina act powerfully upon their contents. The contraction of the vagina may be felt by the attendant. It is this, aided by the action of the abdominal muscles, but chiefly the former, which delivers the breech and inferior extremities in natural presentations. After delivery, the contraction of the os uteri is often sufficiently obvious, and the placenta, when forced into the vagina by the last throes of the uterus, may be expelled from the vagina by vaginal contractions alone. This contraction of the cervix uteri and vagina is extraordinary when we consider that it only occurs after an amount of dilatation and distention sufficient to paralyze many other muscular organs. In this particular it somewhat resembles the bladder, to which, though it is paralyzed by excessive distention, a certain dilatation is necessary before the muscular fibres can act with advantage.

But I may observe, that however important the vagina may be considered in parturition, it is still more remarkable as the organ for the reception of the semen, and for the sensitive and excitor properties of its internal surface. As an organ of sensation, particularly at its outlet, it produces the orgasm of coïtus, the most intense of all the sensations; and as an excitor surface, it brings a greater number of involuntary and reflex actions into operation than any other portion of the parturient canal.

In the next Lecture I shall treat of the Nerves of the Uterine System.

MEDICAL SOCIETY

LECTURE V.

THE NERVES OF THE UTERINE SYSTEM; DISTRIBUTIVE AND DERIVATIVE ANATOMY OF THE NERVES OF THE OVARIA, FALLOPIAN TUBES, UTERUS, VAGINA, AND EXTERNAL PARTS OF GENERATION; OPINIONS OF JOHN AND WILLIAM HUNTER; GROWTH OF THE UTERINE NERVES DURING UTERO-GESTATION.

Sympathies and Synergies innumerable between the uterus and other organs, as well as the scalpel of the anatomist, proclaim the existence of uterine nerves, both in the impregnated and unimpregnated states. The nerves of the uterine system can best be studied as a distinct group, and for this purpose they form a class almost as well marked as the respiratory nerves. This group will include the nerves of the ovaria, Fallopian tubes, uterus, vagina, and the external parts of generation.

I. *The nerves of the Ovaria.*—The ovarian nerves are derived from the renal and spermatic plexuses. In some recent dissections of Dr. Robert Lee, these nerves are demonstrated in considerable quantity. These nerves exhibit numerous ganglia upon the surface, and subsequent to their entry into the substance of the ovaria. They pass to the ovaria in company with the spermatic artery, and pervade the whole organ. Fibres from the spermatic plexus and ganglia pass to the fundus uteri, and communicate with the nerves coming from the os and cervix uteri.

II. *The nerves of the Fallopian tubes.*—These tubes are supplied with nerves from the hypogastric ganglion. A nerve is described as passing on each side of the uterus, from the upper and anterior surface of this ganglion at the neck of the uterus, to the broad ligament and the Fallopian tubes. Dr. Snow Beck describes additional branches to the Fallopian tubes from the nerves accompanying the internal iliac artery.

III. *The nerves of the Uterus.* — The uterus is principally supplied with nerves by the hypogastric and sacral nerves, and by branches from the spermatic plexus. Below the bifurcation of the aorta, the aortic plexus divides into the two hypogastric nerves. Dr. Lee describes the hypogastric nerve as forming, in its descent to the cervix uteri, the hypogastric plexus. This plexus, when it reaches the cervix, terminates in a large ganglion, which Dr. Lee has called the hypogastric ganglion. The hypogastric ganglion is, in the unimpregnated state, on the authority of the same anatomist, from half an inch to three-quarters of an inch in diameter, and is made up of numerous lesser ganglia with their rami of communication. Into the outer and lower surface of the hypogastric ganglion, numerous branches enter from the third, and sometimes from the second and fourth, sacral nerves. This ganglion, thus composed and reinforced, is considered by Dr. Lee as the centre from which each lateral half of the uterus is supplied; from the hypogastric ganglia nerves pass in various directions to the os, cervix, body, and fundus, and are distributed extensively to the muscular structure and the internal surface of the uterus. In the course of their ramifications over and in the substance of the uterus, numerous ganglionic enlargements occur. In the virgin uterus, Dr. Lee has specially directed attention to a beautiful ganglion in front of the hypogastric ganglion, extensively connected with the surrounding nerves, which he has called the Lawrentian ganglion, in honour of Mr. Lawrence; and in the gravid organ, Dr. Lee has described numerous *sub-peritonæal ganglia and plexuses* on the anterior and posterior surfaces of the organ. These ganglia and plexuses maintain extensive communications with each other and with the hypogastric ganglion below, and the spermatic plexuses and ganglia above. The nerves of the virgin uterus are sinuous or undulating in their course, and are invariably accompanied to their terminations by small arteries.

IV. *The nerves of the Vagina.*—The vagina is supplied by branches from the hypogastric ganglion and from the spinal sacral nerves, a very large supply of nervous fibres being distributed to the erectile tissue of the ostium vaginæ.

V. *The nerves of the External Parts of Generation.*—The vulva and perinæum are chiefly supplied by filaments of the genito-crural nerve, branches of the anterial sacral nerves, and the perinæal branches of the pudic nerve.

But besides the *distributive* anatomy of the nerves of the Uterine System, their *derivative* anatomy is highly important, particularly in a physiological point of view.

In the first place, the chain of thoracic and abdominal ganglia of the sympathetic communicate with both the sensitive and motor roots of the spinal nerves, and in this way cerebral and spinal fibres become mingled with the fibres of the sympathetic, and fibres from the sympathetic communicate with the spinal roots. The splanchnic nerves are chiefly formed by these intercommunicating fibres, *from* the spinal roots *to* the ganglia of the sympathetic. The great splanchnic nerve arises from the sixth, seventh, eighth, ninth, and tenth thoracic ganglia; and according to Dr. Beck, from the superior thoracic ganglia also. The lesser splanchnic arises from the tenth and eleventh thoracic ganglia. The great splanchnic enters the semilunar ganglion, and it is by the two semilunar ganglia, and their communicating filaments and lesser ganglia, that the solar plexus is chiefly formed. Into the solar plexus some of the terminal filaments of the pneumogastric and phrenic nerves also enter. These fibrillæ from the phrenic and pneumogastric may terminate in the liver and the kidney, or they may pass through the superior plexuses of the abdomen, to reach the inferior abdominal and even the pelvic plexuses. The renal plexus is formed by branches from the solar plexus and the termination of the lesser splanchnic nerves: the renal plexus also receives fibres from the vagus; and the spermatic plexus is a subplexus of the renal. From the spermatic plexus the ovaria and part of the fundus uteri are supplied. The inferior aortic plexus is the last of the series of abdominal plexuses, and it is connected by a chain of ganglia and plexuses with the solar and renal plexuses, and with the lateral lumbar ganglia. From the inferior aortic plexus the hypogastric nerve descends, forming the hypogastric plexus and the hypogastric ganglion;

with this ganglion branches of the sacral nerves unite; and from this nervous estuary the uterus is finally supplied. If we adopt the view, that the plexuses of the abdomen, like the external plexuses, are mechanical adaptations for mixing nervous fibres from different sources, and apply it to the uterine nerves, it becomes a possibility, and, I may say, a probability, that the uterine nerves are more variously derived than any other nerves of the body. They may be derived from different points of the great nervous tract between the origin of the pneumogastric nerve, in the medulla oblongata, and the origin of the sacral nerves, in the cauda equina. There is no actual impediment to the approach of nervous fibres to the uterus, from the medulla oblongata through the medium of the vagus; from the cervical portion of the spinal marrow by the phrenic; from the thoracic by the splanchnic nerves; and from the dorsal by the compound lumbar branches of the sympathetic, and from the sacral nerves, which latter come directly from the spinal chord. Taking all these facts into consideration, there is no need of continuing to maintain, as some physiologists have done, that the thoracic and abdominal cord of ganglia are centres of reflex actions independently of the spinal marrow. This view was suggested by the obscure reflex actions which are said to occur when a large portion of the spinal marrow has been destroyed. The circuitous paths by which the abdominal and pelvic viscera may be placed, in some degree, in relation with the upper part of the spinal marrow, after the portions of the spinal centre from which they derive their more direct supply of spinal fibres has been destroyed, is a sufficient explanation of such phenomena if they really exist.

The nervous lines I have been enumerating are quite sufficient to account for the communications between the uterus, and the brain and spinal marrow. The communications between the numerous ganglionic centres and the uterus are still more obvious, and there is little question but that the great mass of the uterine nerves is composed of ganglionic fibres. This is nothing more than might be expected, when we consider the immense increase of nutrition over which these nerves have to preside during the whole period of utero-gestation—an increase quite as remarkable as the accession of nervi-motor power at the time of parturition. I have dwelt at length, in former lectures, on the relation of the nervous fibres derived respectively from the brain, spinal marrow, and the ganglia of the sympathetic, to the voluntary, emotional, reflex, and peristaltic motor actions of parturition.

It will be unnecessary for me to enter minutely into the various points of the controversy respecting the nerves of the uterus. The nerves of the unimpregnated uterus were first actually described by William Hunter, in his work on the Gravid Uterus. He described the hypogastric nerve as passing to the uterus, spreading out in branches like the portio dura, or the sticks of a fan, and communicating freely over the whole side of the uterus and vagina. Next, Tiedemann published two plates of the nerves of the uterus, in a subject who died six days after delivery. In one of his plates the fundus uteri is pulled forwards, and a very moderate supply of simple nervous filaments, without any appearance of plexus or ganglion, is represented as coming from the hypogastric plexus. The other plate is a lateral view of the middle and inferior portions of the uterus, with the commencement of the vagina; it represents the hypogastric plexus as supplying very moderately the sides of this part of the uterus, but there is in this plate no appearance whatever of gangliform enlargements on the branches supplying the uterus itself, though there are ganglia visible on that portion of the "plexus gangliosus" supplying the vagina. Other anatomists, as Lobstein, Osiander, and Longet, have either denied the existence of uterine nerves, or they have limited this organ to a very scanty supply.

Dr. Lee was the first to demonstrate, by actual dissections, the extent of the uterine nerves, the existence of numerous ganglia and plexiform arrangements upon the uterus, the nature of the ganglia at the neck, and the distribution of the nerves to the muscular structure and the internal surface of the organ.

It is well known that Dr. Beck has, by the dissection of a gravid uterus, and of an unimpregnated uterus taken from the body of a woman who had borne children, arrived at conclusions widely different from those of Dr. Lee. As I believe in the truth of Dr. Lee's dissections, I shall not refer to those which have been placed in opposition to them, further than to point out the chief points of difference. In the first place, Dr. Beck believes that the nerves of the impregnated uterus are not by any means so large or so numerous as they appear to be in Dr. Lee's dissections. He considers that the nervous arrangement at the neck of the uterus should be called the pelvic plexus, instead of the hypogastric ganglion, and that the sacral nerves do not enter into that portion of this plexus supplying the uterus, but that they are distributed to the vagina and other parts. Dr. Beck further believes that there is no increase in the size of the nerves of the uterus during pregnancy. Briefly stated, I believe, these are the chief differences between the dissections of Dr. Lee and Dr. Beck. Dr. Beck may be considered as the representative of a class who believe that the nervous supply of the uterus is very diminutive indeed, having no relation, as regards size, with the importance of the functions it is called upon to perform.

The opposition to the views of Dr. Lee not only has an anatomical but a physiological bearing. It is sought to prove that uterine action is in great measure or entirely, independent of the nervous system; or that, at the most, its motor functions are limited to the ganglia of the sympathetic. Even Dr. Lee himself leans to the opinion, that the sensibility and contractility of the uterus are in a great degree derived immediately from the ganglia and other nervous structures of the organ: still Dr. Lee can hardly be said to have broken ground in physiology at all; his attention has been so purely limited to dissection and anatomy.

But the plainest facts of physiology, as well as the analogies and facts of anatomy, demand more extensive nervous endowments for the uterus as the principal organ of generation in the female. No one doubts that the uterus is susceptible of pain; this is one proof of a nervous connexion between the uterus and the brain as the organ of sensation. No one doubts that an emotion of the mind may excite the uterus to powerful contractions; this is another proof of nervous connexion between the brain and the uterus. No one denies that, during pregnancy, the uterus affects synergetically the most distant organs, producing the changes in the mammæ and the gastric disturbances, which are so universal; these facts are only explicable by the existence of nervous communications between the uterus on the one hand, and the stomach and mamma on the other. There is no other route than that afforded by the nervous system. No one denies, either, that, after parturition, the breast or the stomach may excite the uterus to action: these facts further prove a reciprocal influence *from* the stomach and breasts *to* the uterus. Such facts are, in their sphere, as convincing as though the eye could see a great concourse of nerves running between these organs. A physiological fact is worth quite as much as an anatomical fibre. These communications can only take place through the medium of nerves, and whether there be one channel or many; whether the chief place be given to the spinal fibrillæ of the sympathetic, or to the proper nerves of the spinal chord, the necessity for uterine nerves is equally inexorable. There *must* be nerves, and there must be nerves *sufficient* for the functions to be performed. Anatomical facts can never give the lie to the facts of physiology.

The next question respecting the nerves of the uterus, one which has been hotly discussed for some years past, and which may almost be called the "still vexed Bermoothes" of the anatomical world, is this: Do the uterine nerves enlarge *pari passu* with the other tissues of the gravid organ during gestation?

This question, as it is disputed at the present day, descends to us from the times of the Hunters. William Hunter's words upon this subject are these: "I cannot take upon me to say what change happens to the system of uterine nerves, but I suspect them to be enlarged in proportion as the vessels." It does not appear that William Hunter ever dissected the nerves of the impregnated uterus himself, or that he ever saw the nerves of the gravid organ dissected out. I have in vain searched his splendid series of engravings for any representation of these nerves, either in the gravid or ungravid states.

John Hunter, in this, as in many other points which occupied the attention of these distinguished anatomists, adopted an opinion directly opposite to that of his elder brother. In his Treatise on the Blood he wrote as follows:—"The uterus in the time of pregnancy increases in substance and size, probably fifty times beyond what it naturally is, and this increase is made up of living animal matter, which is capable of motion *within itself.* I think we may suppose its action more than double, for the action of every individual part of this viscus at this period is much increased, even beyond its increase of size, and yet we find that the nerves of this part are not in the smallest degree increased, and that the nerves and brain have nothing to do with the actions of a part, while the vessels, whose uses are evident, increase in proportion to the increased size: if the same had taken place with the nerves, we might have reasoned from analogy." Thus you perceive the opinion of John Hunter respecting the growth of the uterine nerves during pregnancy was even more decidedly negative than that of his brother William was positive. I may here observe, that the idea respecting the capacity of action *within itself* attributed to the uterus, was also entertained by Harvey. This may be seen by the following sentence from his sixty-eighth Exercitation, which treats of the condition of the uterus of the deer in October, the month after conception. "The uterus at this time being examined immediately after death, the cornua are often seen to move in an undulating manner, similar to the motion of the tortoise, (appearing like the under surface of the snail or slug when it creeps,) just as if the uterus were an animal within an animal, and exercising its own movements." I quote these passages, because there are anatomists even in the present day who have not outgrown the views they embody. I might refer to contemporary authors, who still consider the uterus independent of the nervous centres, as being *animal in animali.* There can be little doubt that the positive dictum of John Hunter has done much to retard our knowledge of this subject.

Dr. Lee strenuously contends for the actual growth of the nerves during pregnancy, and there is no point on which he has met with greater opposition, many anatomists still believing, with John Hunter, that though the other tissues increase in a manifold degree, the nerves remain stationary. Dr. Lee bases his opinions upon the evidence supplied by his numerous dissections. The nerves of the virgin uterus, and of the gravid organ, at the full term of gestation, are, in Dr. Lee's dissections, of very different sizes; the other tissues, the growth of which is so evident, do not appear to have increased more remarkably than the nervous structures. These dissections are very numerous; Dr. Lee has now dissected the human virgin uterus six times, and the gravid organ of fifteen subjects. He has, moreover, dissected the gravid uterus of the mare, cow, and other animals, and has invariably found a large supply of nerves in these dissections. Dr. Lee further teaches, that after parturition the nerves of the uterus diminish in size very rapidly as the uterus returns to the condition natural to the unimpregnated state. He has made a series of dissections of the nerves of the heart, which go to confirm his dissections of the nerves of the uterus. His preparations demonstrate, that the nerves of the right side of the heart are smaller than the nerves of the left, and what is more to the purpose, that the nerves of an hypertrophied heart are considerably larger than the nerves of this organ in its normal state. These dissections are not hidden in a corner; any one may examine them for himself, either at Dr. Lee's residence, or at the museum of St. George's Hospital; and perhaps no dissections that ever were made have been so scrutinized by anatomists of different countries; it is truly a matter of wonder, that in a question so purely æsthetic, so entirely open to the senses, the slightest difference of opinion should exist. I believe I may say, with perfect truth, that those who have been boldest in their disbelief of Dr. Lee's anatomy have been the most chary of personal investigation: they have tested these nerves by their preconceived ideas, rather than with their own eyes and hands.

Probably the increase of the nerves of the uterine system after conception is only one fact of many of a similar kind. To determine the question, all the instances of periodic increase and diminution, distinct from ordinary growth—all the epicycles upon the larger cycles of increase and nutrition, should be examined. Precise observations, following in the track of Dr. Lee, must be made of the condition of the nerves of the virgin uterus, of the uterus of the girl, of the gravid organ after puberty, of the uterus of the multiparous woman in the unimpregnated state, and of the uterus after the child-bearing period has passed. The nerves of the generative system in the young pullet and in the mature hen during the period of oviposition should be dissected. In the same way the mammary nerves of the virgin, the nursing mother, and the nerves of the breast after the period of lactation, should be compared; or these nerves could be examined still more effectually by dissections of the lower animals, where the increase in size and the isolation of the mammary glands are more obvious than in the human female. The male sexual organs also offer opportunities of setting at rest the question respecting the growth of nerves in organs of periodic increase; the nerves of the testis and penis of the youth before and after puberty should be compared; the nerves of the penis and testes of the bull and the stallion, and the nerves of the penis and those leading to the excised testes in the ox and gelding, are also fitted for observation. Then there are animals in which the increase in the testes is temporary, as the sparrow, the frog, or the toad, in each of which a great increase or diminution of the glands takes place in comparatively short periods. There are also other instances fitted for anatomical observation; the growth of the horns of the stag; the whiskers of the feræ, which are supplied with nerves; the fore-limbs of the frog; the tail of the salamander; the deciduous teeth in their growth and decay, and the increase of the permanent teeth. All these taken together, would, after due investigation, afford a body of evidence independently of the uterine nerves, which would establish or overthrow the opinions of Dr. Lee beyond all question. Nothing of this kind has, however, been done by his opponents; the microscope, and the two dissections of Dr. Beck, are the only weapons used against Dr. Lee, and these dissections were not made in the usual manner—the neurilemma, which is one of their component parts, being removed from the nerves. Meanwhile the chief evidence is in Dr. Lee's favour. Those who maintain that the nerves of the uterus do not increase in size during gestation, must show, not only that there is no such increase in the gravid, as compared with the virgin uterus, but they are bound to show, that the nerves relatively diminish in breadth during pregnancy; for when we consider the extent and superficies of the fully-developed gravid organ, it must be evident to the meanest capacity, that if the nerves of the virgin uterus, remaining stationary as regards size, are merely stretched upon, drawn out, or unfolded, over and in, the enormously increased gravid organ, they ought proportionately to appear as much *diminished* as the growing tissues of the uterus are *increased* in size. The length of the virgin uterus is two inches; of the gravid, at the end of gestation, twelve inches. The weight of the virgin uterus is one ounce; that of the fully-developed gravid organ, twenty-four ounces. The disproportion in size between the fœtus and the adult man is not nearly so great as the disproportion between the virgin and the parturient uterus. If we could conceive the nerves of the fœtus stretched out or unwound in the space of nine months, so as to accommodate the skeleton of the adult, we should have but an imperfect idea of the mechanical marasmus of the uterine nerves at parturition, which we are called upon to believe, if the nerves do not actually grow during gestation. In truth, the *argumentum ad absurdum* applies with great force to those who dispute the growth of the uterine nerves in pregnancy.

The questions naturally suggest themselves—How does this increase in the nervous structures, described by Dr. Lee, take place? Is there an increase in the number of fibrillæ, or are the original nervous fibres only increased in size? Is the process of growth active in the ganglionic or in the cerebral and spinal fibres, or in the fibres of all these systems? Now it is not probable that the number of fibres increase, more especially of those fibres which are in relation with the brain and spinal marrow. The growth of the uterine nervous structures must not be compared with the original formation of the nervous system in the fœtus,—for the virgin uterus already possesses its nerves,—but it must rather be compared with the growth of the nervous system from infancy to manhood. We can hardly imagine such a thing as the insertion of new fibres into the spinal chord, establishing new relations with the rest of the brain, spinal chord, and nerves, in an adult animal. We are obliged to suppose the growth to be one of increase in the length and calibre of the fibres already existing, and this may be very well illustrated by reference to the growth of an animal which arrives at maturity during the first year of its existence. Take the cock, for example. At the time of hatching we must believe the nervous system perfect as regards the number of its fibres, because the movements of the chick are as perfect and facile a few days after birth as they are in the full-grown bird, yet there is a great difference between the size and extent of the nervous system of the young chick of one spring, and the gallant chanteclcer of the next. The change in the nervous system can only, according to our present knowledge, arise from an increase in the length and thickness of the nervous fibres, and there is nothing more extraordinary, in the development of the uterine nervous structures, than there is in the harmonious growth of the entire nervous system in animals which reach maturity within a year from the period of birth.

I believe, then, Dr. Lee may fairly claim the merit of showing the extent of the nervous endowments of the gravid uterus, and there can be no doubt that he was the first to attempt, by numerous dissections, to grapple with the problem respecting the growth of the nerves of the uterus during gestation—a problem which a very great number of anatomists, in every part of the world, believe him to have solved. Taken together these points form a very complete anatomical discovery, the more to be prized because Dr. Lee came after so many other observers, who had touched upon this subject without coming to any satisfactory decision, and further, because he has laboured in direct opposition to some of the most celebrated anatomists of the present century.

The opponents of Dr. Lee confidently appeal to the microscope to prove the justice of their rejection of his labours, but the fact of such an appeal would seem a prejudice against him, and a willingness to deny the fidelity of his dissections. The microscope is used to ascertain the intimate physical appearances of nervous and other tissues, but hardly, on ordinary occasions, to distinguish grossly as between nerve, muscle, and cellular tissue. It must be borne in mind, that the nerves of the body generally were dissected and held to be nerves upon other evidence than such as that furnished by the microscope long before this valuable instrument was invented. If, in the case of the uterine nerves, we deny that the tracing of the scalpel or dissecting needle, continuity with other nervous structures, and careful ocular examination—for the debatable structures are quite large enough to be inspected by sight and touch,—if, I say, these are not sufficient to help us to a decision in the case of the uterine nerves, neurological anatomy should begin again, and we ought to question the reality of every nerve in the body; for they hold their title to be considered nerves only on evidence which, if applied to the uterine nerves, answers directly in the affirmative. What should we say of a proposal to apply the microscope to the descendens noni and the digastricus, or to distinguish the muscular fibres of the stomach from the branches of the pneumogastric; yet the nervous and fibrous tissues of the gravid uterus are as palpably presented to the eye as those of the stomach? Possibly—I say, possibly, though I cannot persuade myself that such is the case—Dr. Lee may in his anatomical enthusiasm overrate the quantity of the uterine nerves; he may not estimate sufficiently the amount of cellular tissue still remaining in his dissections. In some of his dissections he does not pretend that he has cleared the nerves of their neurilemma, or completely removed the cellular tissue; and every one accustomed to minute dissection knows that it is next to impossible to do this without removing nervous matter. To my mind the question of the nerves of the uterus does not depend for its answer upon dissections of such marvellous delicacy. These nerves are seen with the greatest certainty in some of the most unfinished dissections of Dr. Lee, just as we sometimes see the design of an artist more forcibly in the original sketch than in the elaborate picture. In many of his preparations—particularly those which are injected—the silver-threaded filaments of nerves are seen shining through the cloudy cellular tissue, in a manner which the nicest art could not hope to imitate; and I fear in this case the microscope will prove to have been a screen, behind which some anatomists have placed themselves, not that they may see, but rather that they may escape the light. It will be right to refer to the evidence offered by Dr. Lee, as well as to that demanded by those who question his views. He himself considers continuity of structure with other acknowledged nerves, as the hypogastric, sacral, and spermatic nerves; the similarity of the nerves of the uterus to the nerves of other viscera, as the stomach and heart; and the circumstance, that each minute nerve, as displayed in injected preparations, is accompanied by a small artery; as affording good and sufficient proof that the structures he has dissected and portrayed in many drawings and plates are *bonâ fide* nerves, ganglia, and plexuses.

But those who seek to reduce Dr. Lee's merits to the very lowest point, ought to accord him considerable praise. There is a sense in which his labours ought to command at least their respect. One of the most eminent writers of recent times has observed,—"That man is not the discoverer of any art who first says the thing; but he who says it so long, and so loud, and so clearly, that he compels mankind to hear him,—the man who is so deeply impressed with the importance of the discovery that he will take no denial, but, at the risk of fortune and fame, pushes through all opposition, and is determined that what he thinks he has discovered shall not perish for want of a fair trial." Tested by this standard, Dr. Lee's title to the discovery of the uterine nerves is indisputable; but for him this department of anatomy would have slumbered on, as it had done all through the great anatomical ages; we should have had nothing beyond the meagre plates of Tiedemann; and though the physiology of the subject might have progressed, it would still have lacked the clear warrant of anatomy. To Dr. Lee alone belongs the merit of having compelled the attention of anatomists to the uterine nerves; this, even those who dispute that his laborious dissections, during eight years, have added a single fibrilla, must, willingly or unwillingly, allow. But I do not make these concluding remarks to qualify my own most sincere belief that he has given us the real anatomy of the uterine nerves, and that he has proved the growth of this system of nerves during utero-gestation.

The nerves of the urinary bladder and the rectum are derived from the same sources as the nerves of the uterine system. We may compare the nerves of the genito-urinary organs, and of the outlet of the intestinal canal, to the par vagum, which is distributed to the respiratory apparatus, the heart, and the upper portions of the digestive tube; only that the inferior vagus is more diffused in its origins and terminations. Probably, also, there is in the lower medullary bulb, from which the cauda equina arises, an analogue of the medulla oblongata; the lower medullary bulb having the same relation to the support of the species, as the upper has to the support of the individual.

LECTURE VI.

PUBERTY; HISTORY OF THE OVULAR OR OVARIAN THEORY OF MENSTRUATION; ANALOGY BETWEEN MENSTRUATION, ŒSTRUATION, AND THE OVIPOSITION OF BIRDS, INSECTS, AMPHIBIA, AND FISHES; NATURE OF THE CATAMENIAL SECRETION; DISEASES OF MENSTRUATION; STERILITY, AMENNORRHŒA, DYSMENNORRHŒA, AND OVARIAN CONVULSION.

At the time of puberty the development of the ovaria takes place, exercising an extraordinary power over the entire female economy. The ovaria become centres, from whence synergetic influences radiate to every part of the system. New emotions arise in the mind; affection, pudency, and desire, for the first time agitate the heart of the virgin. The whole mechanism of expression is informed and beautified with a new spirit; the eyes, hair, lips, voice, gestures, and carriage, are all transformed; awkwardness and disproportion are often metamorphosed into dignity and grace. The ovaria modify the processes of nutrition, and excite that harmonious and plastic power, more cunning than the creative hand of the statuary, which moulds the beauty of womanhood out of the limbs of the girl. The ovaria it is, too, which fit the breasts to give suck, the womb to bear, and cause the bones of the pelvis to enlarge at puberty, for the purposes of parturition. It is, however, to the more immediate function of the ovaria—namely, menstruation, that I must now beg your attention.

The modern Theory of Menstruation, which makes it dependent on the periodical excitement of the ovaria, and the escape of mature ovules from the Graafian vesicles, the secretion of the catamenial fluid being secondary to the ovarian phenomena, may be considered as definitively proved. The fundamental analogy between menstruation in the human female, and the œstruation of mammalia, and the oviposition of oviparous animals, has also been satisfactorily shown; but I believe a comprehensive generalization of all the facts, and their application to the theory of reproduction, still remains to be made. I know of no better mode of placing the theory of menstruation before you, than by tracing briefly the different steps by which we have arrived at our present knowledge of this most interesting subject.

The vesicles of the ovary had been observed by Fallopius and others as early as the middle of the sixteenth century, and probably even before that period. In 1651, Harvey published his great work on the generation of animals, but it was chiefly composed at Oxford during his stay there, between the years 1642 and 1646. The fifth Exercitation contains an extraordinary comparison between menstruation and unimpregnated oviposition, which I shall here quote, and which I shall subsequently have to comment upon. It will be seen, from this passage, that our great physiologist not only saw "the same significance" in oviposition and menstruation, but that he drew a vivid picture of the disorders of celibacy in all animals.

"Many birds, consequently, the more salacious they are, the more fruitful are they; and occasionally, when abundantly fed, or from some other cause, they will even lay eggs without the access of the male. It rarely happens, however, that the eggs so produced are either perfected or laid; the birds are commonly soon seized with serious disorders, and at length die. The common fowl, nevertheless, not only conceives eggs, but lays them, quite perfect in appearance, too; but they are always wind eggs, and incapable of producing a chick. In like manner many insects—among the number, silkworms and butterflies—conceive eggs, and lay them, without the access of the male; but they are still adventitious and barren. Fishes also do the same.

"*It is of the same significance in these animals, when they conceive eggs, as it is in young women when their uterus grows hot, their menses flow*, and their bosoms swell—in a word, when they become marriageable; who, if they continue too long unwedded, are seized with serious symptoms—hysterics, furor uterinus, &c., or fall into a cachectic state, and distemperatures of various kinds. All animals, indeed, grow savage when in heat, and unless they are suffered to enjoy one another, become changed in disposition. In like manner women occasionally become insane through ungratified desire, and to such a height does the malady reach in some, that they are believed to be poisoned, or moonstruck, or possessed by a devil. And this would certainly occur more frequently than it does, without the influence of good nurture, respect for character, and the modesty which is innate in the sex, which all tend to tranquillize the inordinate passions of the mind."

De Graaf had seen the human ovum descending through the Fallopian tube as early as 1668. In the *Philosophical Transactions* for 1672, there is an account of the inquiries of Kerkringius, a continental physician, in which the Graafian vesicles of the virgin ovarium are called eggs, and are described as similar to the eggs laid by birds, without commerce with the male. In this paper he says, "Feminæ desjiciunt hæc ova imprimis tempore menstruorum, vel in iræ vehementia." Kerkringius had seen the impregnated ovum in the uterus, and he believed it was nothing more than the Graafian vesicle, or egg of the ovary, enlarged by impregnation. He gives the figure of an ovum, of the size of a black cherry, which he had taken from the body of a woman who had died three or four days "post fluxum menstruum." Suspecting that, in this case, conception had taken place subsequently to menstruation, he says he took the husband aside, to ask him, "Num a tempore fluxus menstruorum uxorem cognovisset?" The answer was in the affirmative, and it strengthened his hypothesis. Kerkringius is far, however, from laying down the escape of his hypothetical ova as the *law* of menstruation: his positive errors consist in his supposing that the vesicles of the bigness of a pea found in the virgin ovarium were veritable ova, and that the impregnated ovum found in the uterus was merely an ovarian vesicle enlarged by impregnation; he further erred in imagining that anger played any part in the process of oviposition. The hypothesis of Kerkringius appears to have soon fallen into abeyance. The more accurate knowledge of the ovarian vesicles promulgated about this time by De Graaf, must have surrounded it with doubt. It was so very evident that the ovarian vesicles could not, on account of their size, pass through the Fallopian tubes entire, and the real ova were then entirely unknown. Menstruation, therefore, continued to be considered strictly as a function of the uterus, without any special reference to the ovaria.

In the year 1797, Cruickshank, William Hunter's favourite pupil, examined the body of a woman who had died during menstruation, and he observed that the peritonæal coat of the ovarium was ruptured. He says of this case, "I have also in my possession the uterus and ovaria of a young woman who died with the menses upon her. The external membranes of the ovary were burst at one place, from whence I suspect an ovum escaped, descended through the tube to the uterus, and was washed off by the menstrual blood." This observation of Cruickshank appears to have been a solitary one. It was, however, a great advance upon anything which had been observed before, but no deduction or explanation respecting the essential nature of menstruation appears to have been suggested by it to his mind.

The Ovular theory of menstruation was next revived, or rather originated, by Dr. John Power, who made it the subject of one of his Essays on the Female Economy, published in 1821. By an intuitive sagacity, based on many original observations of his own, and on the facts and opinions of his predecessors, he arrived at the conclusion, then stated distinctly for the first time, that at every menstrual period an ovule reaches maturity in the ovarium, and is discharged from it during the flow of the catamenia. He taught that the catamenial secretion was excited in the uterus by the condition of the ovaria, and that the menstrual fluid was an imperfect attempt at the formation of the decidua; the ovarian stimulus when the ovule is unimpregnated, not being sufficient in ordinary cases to excite the deposition of fibrin, but stopping short at the menstruous secretion. He, however, drew attention to the fact, that in certain cases of dysmenorrhœa the ovarian stimulus is greater than usual, and that then the false membrane of dysmenorrhœa may be formed. He looked on the uterine phenomena of the menstrual function as an abortive attempt at the formation of a deciduous membrane, preparatory to the reception of the abortive ovule. So far, there is little to add to the theory of menstruation at the present time. I should mention to you that Dr. Power does not seem to have been aware of the observation of Cruickshank or Kerkringius. His essay contains the most striking evidence of an original genius. It must, however, be said, that the ova of Dr. Power were almost as hypothetical as those of Kerkringius; he knew of no ova except the vesicles of Kerkringius and De Graaf, and he drew a wrong analogy in comparing the formation and expulsion of the membraneous secretion in dysmenorrhœa, to the extrusion of the unimpregnated egg of the pullet; and while he recognised the analogy between the uterus, as the nidus of the human ovum, and the nest of the bird, he appears to have failed to see any analogy between œstruation and menstruation. With these drawbacks, which are not very important, considering the state of physiology twenty-five years ago, the classical essay of Dr. Power is quite on a par with the last word of science, and it affords a very remarkable and beautiful instance of the advance of theory before fact, as we shall immediately see. His mind saw the inevitable necessity for the existence of ova, and he wrote as though he had actually observed them.

In 1831, Dr. Robert Lee examined a woman who had died during, or shortly after, menstruation, and, like Cruickshank, he found the peritonæal coat of the ovary perforated over the site of a Graafian vesicle. Other opportunities of dissection followed, and four similar cases were published by Dr. Lee in 1833. Dr. Lee not having seen ova in the Graafian vesicles, refused to admit the existence of hypothetical ova. Cognizant of no ovum except that which had been found in the uterus and Fallopian tubes after impregnation, and the escape of which from the Graafian vesicles seemed, on account of their size, an impossibility, he repudiated the theory of Dr. Power, and pronounced that menstruation depended on some unknown change in the Graafian vesicle. Dr. Lee refused to go a step beyond his own facts. At the time he was perfectly right; but the progress of knowledge soon converted Dr. Power's hypothesis into an intelligible and tested theory; and in this process Dr. Lee's observations were of the greatest assistance. They were, in fact, the anatomical part of the discovery.

In 1827, the missing link in the chain had been detected by the discovery, by Baer, of the minute ovule within the Graafian vesicle; and if Dr. Lee had only succeeded in seeing the ovule of Baer, his knowledge of menstruation, after his dissections, would have been complete. As it was, he did not interpret their true meaning. Baer's discovery, which converted the Graafian vesicle into an ovisac, supplied, with the original dissections of Dr. Lee, the complete verification of Dr. Power's views. Other observers—MM. Negrier, Gendrin, (whose observations were most important,) Raciborski, Mr. Mayo, Dr. Girdwood, and others, followed with testimony to the truth of the escape of an ovule from the Graafian vesicle at each catamenial period. Dr. Girdwood has endeavoured to show that in young women who have died after menstruating a few times only, the number of menstruations correspond with the number of cicatrices on the surface of the ovaria; following Mr. Mayo, he points out that the puckered condition of the ovaria in elderly females are referrible to the numerous cicatrices of the whole menstrual era. There are circumstances which militate against the numerical opinion of Dr. Girdwood—namely, that there may be the rupture of two or more vesicles at a menstrual period, and it is possible for a menstrual period to pass over without the rupture of a single vesicle. Dr. Girdwood further contends for the analogy between menstruation and œstruation, adducing some interesting facts on this point, drawn from the observation of the menstrual and œstrual secretions, and from instances in which he believes that the duration of gestation in animals is a multiple of the œstrual, just as pregnancy is a multiple of the menstrual period. Many valuable observations had been previously made by Dr. Laycock respecting the periodicity of œstruation in the lower animals, all of which corroborate the analogy between the functions of menstruation and œstruation. Professor Bischoff has brought direct experiment to bear on the subject, and has shown most positively, that at the œstrual period of animals, ovisacs are commonly ruptured, and the escape of ova occur, whether the male be admitted or not.

Lastly, certain aberrations of the ovular theory of menstruation have been observed by Dr. Ritchie, of Glasgow. He ascertained, from the dissection of numerous females who had died at all periods of life, and under all circumstances, that ovisacs are occasionally ruptured, and ovules expelled, in childhood, and at other times than the menstrual periods, in women during the childbearing era; and that in some cases the ovarian excitement accompanying menstruation does not proceed so far as the rupture of the peritonæal coat, and the shedding of an ovule. Still these are exceptional cases; in the great majority of instances there is ovarian excitement, and the escape of one or more ovules, during the flow of the catamenia. The conclusion I should draw from Dr. Ritchie's papers is, that in certain cases the ovarian action of menstruation is incomplete; that though it excites the catamenia it is insufficient to cast off an ovule. The ovules shed in the intervals between the catamenial periods, without any uterine discharge, are probably either immature, like those of childhood, or they may escape from the ovaria without a sufficient degree of ovaria nexcitement to set up the catamenia, being in this respect the antithesis of those other cases in which there is the uterine secretion without the extrusion of ova from the ovarium. In perfect menstruation, both ovarian excitement and the escape of an ovule concur; but the ovarian excitement is absolutely indispensable.

We may now retrace our steps, in order to follow more rapidly the facts which prove the Ovular or Ovarian Theory of Menstruation. De Graaf had seen the ovum in the Fallopian tubes as early as 1668, and they continued to be observed there, and in the uterus, by other anatomists; but the difficult point was, to learn from whence the ovum originated. Harvey, as the result of his examinations of the King's deer, had positively asserted that it did not come from the ovary. Kerkringius subsequently broached the ovular hypothesis of menstruation, but in a very incomplete form. The earliest fact pointing out the mode of escape of the unimpregnated ovule from the ovarium was observed by Cruickshank. The first decisive group of facts was observed by Dr. Lee. Meantime, the future theory of menstruation had been fairly constructed by Dr. Power, and the discovery of the ovule within the Graafian vesicle, or ovisac, following upon this, rendered both the facts and the theory complete. When the theory of menstruation had been thus established, the nature of conception was evident; the relation of menstruation to fecundity, and the common occurrence of impregnation immediately after the menstrual period, were easily comprehended. There is no doubt that at the latter part of each menstrual period, and immediately after its conclusion, when the ovule is ready for impregnation, there is an actual increase of the sexual emotion in women, though this is greatly disguised by natural modesty and reserve.

The theory of menstruation was very much ridiculed when first propounded by Dr. Power. Its author was treated as a visionary, and I have heard he acquired among accoucheurs the name of "Menstruation-Power." His little book was severely scourged by the critics of that time; but the event is another proof, that whenever ideas of sterling worth are put forth, the world, even if it do not at once appreciate their value, is sure to find them "after many days." Dr. Power himself seems to have been little careful about the result; he never appears to have discussed the matter, or even resorted to experiments; but to have calmly thrown his ingot of gold into the stream of time, there to be refined, instead of casting it into the burning fiery furnace of controversy, for that more rapid assay which original minds sometimes covet. Very recently, I paid a visit to him, at his residence at Westminster, and I am proud to say he was much interested in my own researches in the physiology of Parturition. I found him amusing himself with painting and composition. He showed me some geological landscapes, if I may so term them, from his pencil, the still-life and figures of which were composed from the study of geological strata and fossil remains; icthyosauri, plesiosauri, and other monsters basked, or pursued their prey, in scenes belonging to a primeval world. I mention this to show the original turn of the mind to which we owe the true theory of menstruation. It is little to the credit of our profession or of science that he has never received any reward whatever for his beautiful discovery. Indeed, until recently, it was not known whether he was alive or dead. He has neither courted nor received the distinctions and honours of learned societies, British or foreign: born of a family in whom medicine may be almost said to be hereditary, and of which, until very lately, three generations of physicians were living, he has still no other title or distinction save the M.D. of his professional diploma.

But it will be necessary not only to study menstruation by itself, but to assign it its true place in the physiology of reproduction. Dr. Laycock, Dr. Girdwood, and Professor Bischoff have already established the analogy between menstruation and œstruation. As far as the ovaria are concerned, this analogy is perfect, the only differences are in the nature of the uterine and vaginal secretions, and the absence or control of the sexual rage which characterizes the mammalia in general. With respect to the oviparous and ovoviviparous animals, the analogy is not, at first sight, so perfect. Harvey, on more than one occasion, compares the uterus to the nest of birds; and Dr. Llewellen, his first translator, gives, in the not inharmonious verses prefixed to the translation, and in which he sets forth the theme of his original, the following line. It embodies an important physiological truth:—

"To conceive is but to lay within."

Harvey himself, in a passage I have already quoted, made a comparison between menstruation in the virgin, and the infecund oviposition of birds, insects, and fishes; and though there is an immense difference between his vague idea and the development of the subject as it may now be studied, still this glimpse of the true analogy was a fruitful germ, a genuine mother-thought. Harvey foresaw a connexion between these apparently remote phenomena; and this prescience of his magnificent genius, fertile as the subject to which it was devoted, has always seemed to me as remarkable as Sir Isaac Newton's prophecy of the burning of water or the diamond.

Dr. Power adduced, in his essay, analogies between the development of ova in the ovaria, at menstruation, without impregnation; and the maturation of ova in the hen or pullet, and in amphibia and fishes, without the influence of the male; he even instituted a comparison between the human ovarium, in menstruation, and the seed-pod or ovarium of plants. As I have already mentioned, Dr. Power's comparison of the membraneous formation of dysmenorrhœa with the egg of the unimpregnated pullet was incorrect. The menstrual fluid, of which the membraneous secretion is an excess, is comparable, not to the entire egg, but to its outer shell. The catamenial fluid is most probably, I may say certainly, intended as an envelope for the ovule escaping from the ovarium, but unless impregnation takes place, no relation ever occurs between the uterus and the ovule. There is a dislocation, so to speak, between the outer membranes of the human ovule, in menstruation; and if, in menstruation, the ovoid membrane is formed, it is entirely disconnected from the proper ovulum. The ovoid membrane of dysmenorrhea, and the ovule proper, are discharged separately. In birds, on the contrary, whether impregnation take place or not, the external covering of carbonate of lime, instead of coagulable lymph, is deposited. The function of the human uterus is, in the bird, performed in part by the uterine cavity, in part by the nest. The preparation of the human uterus for the impregnated ovum is the analogue both of nidification and the secretion of the shell of the egg of the bird. With this difference, then, relating to the external envelope, menstruation is closely analogous to the unimpregnated oviposition of the bird, while conception is analogous to the deposition of the impregnated egg.

Menstruation is, in fact, the unimpregnated oviposition, while conception is the impregnated oviposition, of the human subject. The analogy between menstruation and the oviposition of those amphibia and fishes which are impregnated out of the body, is very close; in them, as in the human subject, the ovarian excitement and the extrusion of ova are periodic, and may occur without the intervention of the male. I shall have to dwell on these analogous functions more at length, when I come to treat of the Cause of Labour. Menstruation is an ovarian rather than an uterine function, and it may be considered as the first act of human parturition—it is the parturition of the *Ovule*, instead of the parturition of the *Ovum;* and it represents, with the exception I have already dwelt upon, the whole of parturition in birds, and in many fishes and amphibia. The mechanism by which the ovule is conveyed from the ovarium to the uterus I have explained in former lectures—namely, the reflex and peristaltic action of the Fallopian tubes. To the manner in which the tubal portion of the parturient canal is excited to act in a reflex form, by the ovarium, and in a peristaltic form, by the ovule, I would direct your special attention and memory.

In treating of menstruation, I have attempted to keep your minds fixed on the ovaria as the theatre of the essential phenomena of this function, and because their actions have an intimate relation to parturition. The secretion from the internal surface of the uterus is purely secondary. I do not believe that there is a single fact on record to show that the catamenia is secreted from the uterus in the absence of the ovaria. Cases in which this has been supposed to happen are probably not truly menstrual, but similar to the hæmorrhoidal discharges in the male, which are sometimes periodic. But there are recorded instances in which all the pain and excitement of menstruation have occurred regularly in women in whom the ovaria have been present, and in whom cicatrices have been found upon the ovaria, but with the uterus entirely wanting. I firmly adhere to the opinion of Dr. Power, that the catamenial secretion or exudation is an abortive attempt to place the uterus in a position to receive and attach the ovum to its cavity. When Dr. Power wrote, the nature of the menstrual secretion was not understood, its identity with the blood was disputed, and especially it was said that this fluid contained no coagulable matter. But some recent observations of Mr. Whitehead, of Manchester, are very interesting upon this point. He has found that when the menstrual secretion is received directly from the os uteri, through the opening of a pessary or by means of a speculum, it always contains coagulable matter, and coagulates like ordinary blood; and he has further ascertained that its coagulability is lost during its passage through the vagina, the cause being in the acidity of the vaginal secretion. Mr. Whitehead has invariably found the uterine secretion alkaline, and the vaginal secretion strongly acid, and he traces a final cause for this acidity in the prevention of coagulation in the uterine secretion. If, he argues, the menstrual blood coagulated, there would be difficulty in its expulsion, and it would remain to decompose within the uterus and vagina. The menstrual blood is probably secreted from the internal surface of the Fallopian tubes as well as the uterus. You know how commonly it is said that the generative canal, unlike all the other mucous canals, opens directly into a serous cavity. This is only true of the Fallopian tubes while they remain inactive. When the peritonæum has been perforated, and the fimbriæ of the tubes are closely applied over the ovaria in the sugescent embraces of menstruation and conception, and probably also, of parturition and coïtus, the channel from the ostium vaginæ to the internal structure of the ovarium is as direct and unbroken as that of the ureter into the kidney: the generative mucous canal becomes quite independent of the peritonæal cavity.

Gregory has beautifully said, "Hæc Naturæ lex, hoc consilium; ut singuli pereant homines, gens humana floreat." This is exemplified in the phenomena of menstruation, conception, and parturition. The identical processes which frequently lead to disease and death in the individual are resorted to by Nature for the separation of the ovule and the ovum from the parent system, in the perpetuation of the species. In pathology, how often do we see death caused by the exudation of fibrin in the trachea, or by perforation of the intestine, or by sphacelus, from obliteration of the vessels of a part. In the transmission of the race, we see an increased action perforate the peritonæum, for the escape of the ovule; we see coagulable lymph thrown out in the Fallopian tubes and the uterus, to effect the adhesion, and for the support, of the ovum during utero-gestation; and lastly, on the conclusion of pregnancy and parturition, compression of the uterine vessels on the maternal side, and a diversion of the circulation on the side of the fœtus, cut off the supply of blood to the placenta, when it is forthwith expelled as dead matter. So nearly aro death and life connected!

Having convinced ourselves that the ovaria are the organs primarily concerned in menstruation—that the catamenia are the effect, and not the essential part of this function—we shall be short-sighted, if we do not at once refer many of the disorders of menstruation, not to the uterus, but to the ovaria. I know of few applications of the modern physiology of menstruation to practical medicine. One of the most important is the plan of treatment recommended by Professor Naegelé in sterility. He prescribes, that in certain cases coïtus should take place during the presence of the catamenia. In many other cases the ovular theory of menstruation suggests that the greatest attention should be paid to women affected with sterility immediately after the cessation of each catamenial flow. In the middle of the interval between the periods, there is little chance of impregnation taking place. The same kind of knowledge is of use, by way of caution, to women who menstruate during lactation, in whom there is a great aptitude to conceive; pregnancy, under such circumstances, would be injurious to the health of the fœtus, the child at the breast, and the mother herself, and therefore should be avoided, if possible. Another application of this theory has been in the more satisfactory determination of the duration of pregnancy, and the explanation of those cases in which pregnancy is prolonged beyond the tenth catamenial period.

Amenorrhœa and amenorrhœal sterility are clearly affections, not of the uterus, but of the ovaria. When we give emmenagogues empirically, with a view merely to excite the menstrual flow, we place medicine far in the rear of physiology. The essential cause of amenorrhœa is in the absence of the periodic ovarian excitement, and the maturation of ova. We can only cure amenorrhœa by bringing the ovaria into that condition which admits of their periodic excitement and the extrusion of ova, and this we must do either by local or general stimuli, or both. If in a case of amenorrhœa we paint the inner surface of the uterus with nitrate of silver, as some have recommended; or inject a solution of ammonia, and so produce the uterine secretion, we do not cure the amenorrhœa, unless, indeed, these agents affect the ovaria at the same time; we, in fact, only remove a *symptom;* for the amenorrhœa, the absence of the menstrual flow, is a *symptom*, and not the whole *disease.* We want a new term, which shall include both the ovarian and uterine conditions of this disorder.

In dysmenorrhœa, or painful menstruation, the greater portion of the pain consists, I am convinced, of ovarialgia; the deep lumbar pain is decidedly ovarian, and not uterine. Many women suffer so much lumbar pain at each menstrual period, that it resembles, and, indeed, almost amounts to, a monthly attack of ovaritis. Almost all women in the better classes suffer so much pain and disturbance from menstruating, that we may almost venture to say menstruation, like parturition, lies in debateable ground, between physiology and pathology; but of this more hereafter. Part of the pain of dysmenorrhœa, then, is ovarian, and that which is uterine is often symptomatic of ovarian disorder. In dysmenorrhœa, there is doubtless a pathological state of the uterus induced; but there would be no uterine excitement without the previous excitement of the ovaria. On the other hand, there are patients in whom the uterus is wanting, from congenital deficiency, who suffer all the ovarian pain of dysmenorrhœa. Uterine disturbance must be considered as a secondary condition—an aggravated symptom of ovarian excitement in painful menstruation. Of one part of the uterine pain of dysmenorrhœa, I have a word to say—I mean, that which women call the bearing-down pain, and of which they complain so much from the pubes downwards to the knees. This bearing-down I believe to be a tenesmus of the os and cervix uteri; it is most frequent and severe in women who have borne children, and in whom the os and cervix have been developed. I have before directed your attention to the points of similarity between the healthy actions of the various sphincteric muscles; you will find the pathological analogies equally interesting. The tenesmus uteri is analogous to the tenesmus of the bowel, or the tenesmus of the bladder. These spasmodic affections of the outlets of the sexual, urinary, and intestinal canals, are comparable with many other spasmodic symptoms. Thus, the globus hystericus, or pharyngismus, is a contraction of the pharynx, and the laryngismus affecting the larynx, and the form of cardialgia dependent on contraction of the cardia, are analogous affections of the respiratory and digestive tubes. Of course, where there is disease of the os and cervix, the tenesmus uteri will be more distressing than usual, and will often require the chief part of our treatment, yet the ovarian excitement in the background must not be forgotten. I am decidedly opposed to the view that dysmenorrhœa is *caused*, in the majority of cases, by chronic inflammation of the os and cervix uteri. The relation between dysmenorrhœa and inflammation of the os uteri is generally one of coincidence, not of causation, nay, it is often a symptom induced by ovarian irritation, a symptom requiring palliation, but the relief of which by no means constitutes the whole of our treatment. Let any one who believes in the merely uterine theory of dysmenorrhœa, closely examine the nature and seat of the pain; he will speedily be obliged to recognise the paramount influence of the ovaria. Of course, wherever there is inflammatory action of the os and cervix, the inflammation will be rekindled at every menstrual period, and constitute a variety of painful menstruation; what I am contending against is, the too exclusive attention of the practitioner to this superficial form of dysmenorrhœa.

But the most serious disorders of menstruation are the hysteric and epileptic convulsions, which are sometimes excited by the ovarian irritation. The first attack of epilepsy frequently invades women at the coming on of a catamenial period; young girls are liable to convulsive attacks on the first appearance of the catamenia; and in confirmed epileptics the fits are always most violent and prolonged during the accession of the periods. *Ovarian irritation is, I am persuaded, the most important of all the causes of epilepsy in the female.* Ovarian irritation is also a fruitful source of hysteric convulsion, and there is no other state of the economy in which the fits of hysteria and epilepsy run so much one into the other, and where the diagnosis requires to be made with equal care. In these cases it is not so much the uterine as the ovarian excitement which is the cause of the convulsion. It often happens that the fits of epilepsy occur before the commencement of the uterine secretion, when there is little uterine disturbance, and that they cease immediately on its appearance, the secretion from the uterus effectively depleting the neighbouring ovaria.

The influence of the ovaria upon the intellect and the emotions are as remarkable in diseased as in healthy states. At each catamenial period the temper is disturbed in women of irritable constitution—in some women almost to madness. Indeed, the ovaria appear to be an exciting cause of insanity in unmarried females, in the puerperal state, and at the catamenial climacteric. At the catamenial climacteric a revolution of the emotions commences, which requires especial study. General hyperæsthesia and hyper-emotion exist at this epoch, of the most distressing character, both to the patient and her friends. Not the least singular feature of mental disturbance from ovarian irritation is the sudden appearance and subsidence of the disorder. The most violent mania may appear almost without premonition, and disappear as abruptly. But I can only allude to these subjects, and to the influence of the ovaria in chlorosis, anæmia, hysteria, and various other affections peculiar to the sex.

In all such affections the treatment must be, not merely that which removes uterine disorder, but that which relieves undue ovarian excitement and irritation, both in the intervals between the periods and during the periods themselves. In the pathology as well as in the physiology of menstruation the first place must be given to the ovaria. Their pathological synergies are quite as decided as those of a physiological kind.

MANCHESTER MEDICAL SOCIETY

LECTURE VII.

THE PRINCIPAL MOTOR PHENOMENA OF PREGNANCY — EMESIS, COUGH, TENESMUS, STRANGURY, CRAMP, AND ABDOMINAL MOVEMENTS; ELUCIDATION OF THE REAL NATURE OF THE MOVEMENTS GENERALLY CONSIDERED TO BELONG TO THE FŒTUS.

Emesis occurring in the earlier months of pregnancy is so generally a reflex affection, that I scarcely need insist upon it. The morning sickness depends sometimes on the influence of the impregnated uterus on the brain, and the sensations of giddiness and nausea; sometimes on the vitiated gastric secretions, the state of the uterus exerting a marked influence on the secreting surface of the stomach; but it is usually excited as a reflex act by the irritation of the uterine nerves. In ordinary cases, women suffer only temporary inconvenience from morning sickness, and there is a general belief that it conduces to safe and easy parturition. It is very probable that the nausea and sickness favour the rapid enlargement and growth of the uterus, the dilatation with hypertrophy, if it may be so called, which affects this organ. The sickness is most severe in the early months, when the mechanical irritation is pelvic, and diminishes or ceases when the irritation is abdominal, and the disposition to increase fully established. When the disorder is severe, the indications of treatment are, to diminish the cerebral giddiness by caution in assuming the upright position in the morning; to improve the secretions of the stomach and upper portion of the intestinal canal by a gentle emetic occasionally, of warm water, chamomile infusion, or the sulphate of zinc; and to allay uterine irritation by warm water enemata, the daily use of an opiate liniment to the breasts, the application of a few leeches to the vulva, or wearing a pad dipped in spirit lotion upon the external parts. To the epigastrium we may apply a liniment of opium or morphia, ice, leeches, or a small blister, in order to allay irritation of the stomach. As in these cases we cannot remove the cause of the sickness until the time of parturition, the vomiting may become so incessant, that it shall be necessary to induce premature labour, whether the infant be viable or not, to save the mother from death by marasmus. Only a short time since the medical journals contained the particulars of the death of a pregnant woman from the exhaustion of irremediable vomiting, in whose case no attempt was made to induce premature delivery. This was on the Continent: in our own country such a case would cover any practitioner with deserved censure.

The irritation of the uterine system in pregnancy excites distressing cough in some cases. The uterine cause remaining, we can only palliate the uterine and pulmonary disorder. It is curious, that in cases of consumption the uterine disturbance often acts as a derivative, and soothes the cough; and I have known an asthmatic patient whose only freedom from the fits of asthma occurred during her pregnancies.

The rectum and bladder are also excited to action by the uterus, particularly at the commencement and termination of pregnancy. The tenesmus and strangury are partly caused by mechanical pressure on the rectum and cervix vesicæ, and are in part reflex acts excited by irritation of the uterine nerves, To relieve these symptoms, local depletions, if they are sufficiently severe, and washing out the rectum with enemata of warm water, are advisable. A warm enema is both an internal warm bath, and cleanses the intestines of sordes and fæcal matter; it may be rendered still more efficacious in allaying pain, by the addition of ten or fifteen drops of laudanum.

Cramp, particularly of the lower extremities, is a very common and troublesome attendant on pregnancy, and sometimes it exists, to a distressing degree, during or after labour itself. This affection is generally considered to depend on pressure upon the sacral nerves; a little reflection will, however, show us that this is not its true cause, but that it ought to be classed with the morbid reflex actions. Long continued pressure, applied in the course of nerves, may produce numbness or entire loss of sensation, or it may weaken the motor power, but it does not cause muscular spasm. That cramp is caused by the pressure of the gravid uterus is improbable, because it is most frequent during the night-time, and in the recumbent position, when this pressure is least exerted; and still more so, because it sometimes affects the upper extremities, where pressure of any kind is out of the question. The cramp of pregnancy is like the cramp of cholera from irritation of the bowels, or of paralysis from intestinal accumulations, only milder in its form. In pregnancy, the cause may be either in the uterus or the intestinal canal. To comprehend the subject thoroughly, every form of cramp or painful spasmodic action ought to be associated and studied together. They are all allied in their nature, from the simple spasm of one or two muscles, in temporary cramp, up to the almost universal spasms of tetanus. Internal or external irritation of excitor nerves are the general causes of this painful affection. Visceral irritation of some kind or other is the cause of the cramp of pregnancy, paralysis, cholera, spasmodic tic, and certain tropical fevers; while external irritation is the cause of local trismus and the cramp of the swimmer. In the cramp of the drowning person, which is a tetanoid affection, suddenly induced, the external impression of cold is the cause of the general spasmodic seizure which neutralizes the voluntary efforts, and renders the strongest swimmer helpless. There are some persons who cannot dip a limb into hot or cold water, or enter a warm or cold bath, or even enter a cold bed, without being seized with cramp.

I have often mentioned to you that there is an harmonious and reciprocal action of contraction and dilatation between the sphincters, of considerable importance in Parturition and Obstetricy. I have referred particularly to the reflex dilatatious of the glottis and cardia, and the sphincteric muscles of the bladder, rectum, and vagina. Mr. Vincent, in his excellent Observations on Surgical Practice, recently published—a work rich in original thought—shows, in a clear and admirable manner, that the same reflexion, or reciprocity of action, goes on in the muscles of voluntary motion, and is capable of a practical application to the relief of cramp and the reduction of dislocations. I cannot do better than quote so much of his remarks as apply to cramp. "If cramp occur in one muscle, as in the extensor of a joint, and the flexor of the same joint be put into strong action, the cramp ceases immediately. If the extensor pollicis proprius of the foot (a very common muscle for the occurrence of cramp) be the one affected, it is only to put into action strongly the flexor pollicis longus, by pressing the toe against some substance, when all cramp at once ceases. These two muscles are associated by reciprocity of action, and as the one motion is strongly called forth, the other gives way to the minimum of action, and thus the cramp is removed by the law of consentaneity existing between all muscles of one joint. The biceps flexor cruris is also a muscle very liable to cramp; by bending the leg on the thigh, and rotating the tibia inwards by means of the inner hamstrings, the foot being pressed against some resistance, at once the cramp goes. Rubbing a cramped muscle rather adds to the suffering, and the approximating the attachments, or what is called relaxing the muscle, has no effect at all." In pregnancy the muscles most frequently affected with cramp are the gastrocnemius, or the extensor proprius pollicis, and relief may be obtained in the manner mentioned by Mr. Vincent, or by bending the foot upward by the action of the tibialis anticus. This mode of relieving cramp, often instinctively had recourse to, requires a strong effort of the will, and some courage, as at the instant of giving way the suffering is momentarily increased. The radical relief, or prevention of the cramp of pregnancy, lies in the removal of irritating matters from the rectum and large intestine by mild enemata, and by subduing uterine irritation as much as possible.

During pregnancy certain movements are felt in the abdomen by the mother, and they may also be perceived by the accoucheur during the latter months. These movements are almost universally and entirely attributed to the fœtus: there is hardly a point relating to utero-gestation upon which greater unanimity prevails. Scarcely any difficult case of labour occurs in which the presence or absence of these movements do not influence the practitioner. Operations involving the chances of safety to the mother are frequently made to depend upon the presence or absence of this presumed sign of the life of the fœtus.

This state of things often leads to the most serious mischances in practice. I could put my finger upon many recent cases which prove this. In one case, delivery was waited for with much anxiety, and every preparation was made to perform the Cæsarian operation, when the patient was delivered of a putrid child, which had been dead in utero a considerable time. In another and more lamentable case, a young woman was accused of illicit pregnancy. This sign and other circumstances concurring, she herself believed in the existence of pregnancy, and her shame and disgrace hastened her death. An autopsy proved that no pregnancy had ever existed; there had been no movements save those natural to the abdomen. A multitude of instances might be cited to prove how entirely fallacious is this test of pregnancy.

If the abdominal movements in the latter months of pregnancy are very carefully observed, two tolerably distinct kinds of motion may be made out. The one is a movement traversing irregularly over the abdomen, and conveying the sense of hardness either in ridges or in eminences underneath the hand. These movements are often felt at several points of the uterus simultaneously, and are accompanied by pain. When the hardness is most apparent the patient will say that the child kicks and hurts her. These movements will in some cases continue for hours together, particularly at night. When very violent, they give the idea of a blow or a succession of blows, if the hand be laid upon the abdomen. The other kind of movement is distinct from that I have been describing; it conveys to the hand a sudden shock or impulse, like that obtained by repercussion in ascites, only stronger. The abdomen gives, as it were, a sudden shudder; it is like the quick and temporary movement of a young infant touched in its sleep. The first and most frequent of these movements I believe to be purely uterine; the second, fœtal, and to be felt only in undoubted pregnancy.

I proceed to state to you my reasons for believing that the general opinion upon this subject is an error, and that the chief part of these abdominal movements do not depend upon the fœtus, but are true peristaltic movements of the uterus itself.

These movements are often distinctly felt by the mother at the period of quickening, about the sixteenth week, and subsequently. They may in ordinary cases be felt externally after the beginning of the fifth or sixth month.

At these dates the fœtus is very small, for it is during the latter months that the chief increase takes place; and the anterior and posterior extremities are smaller in proportion than the rest of the body.

Professor Naegelé the younger, teaches that the movement of the limbs of the fœtus may be *heard* by the stethoscope, before the sound of the fœtal heart is audible — namely, before the expiration of the fourth month. These sounds are vaunted as of very great importance as a new and infallible sign of pregnancy. I need hardly say that I consider such precocious movements fabulous so far as the fœtus itself is concerned, and as being really referrible to the uterus. I believe, also, that the early period at which the abdominal movements may be felt by the mother herself, or during an examination, affords strong evidence that they do not belong to the ovum. In the domestic animals, the dog or cat for instance, the abdominal movements of pregnancy may be watched with the greatest ease; and when the mother is killed, and the abdomen opened, or the young animals removed in the membranes, they are undoubtedly seen to move. It is straightway concluded, that the embryos were the cause of the movements observed externally. Nothing can be more erroneous. I shall show you, by and by, when I come to treat of congenital asphyxia, that these movements of the embryo after the death of the mother, or after removal from the uterine cavity, are in reality the movements of dying by asphyxia, and consequently not to be compared to any movements occurring in normal gestation. Such are the facts; yet the supposed identity between these really different movements has been a fertile source of confusion among obstetricians. The chick, it is true, during the concluding days of incubation, manifests signs of uneasiness and motion, but no comparison between the chick and the fœtus is admissible on this point, because of the respiration which goes on before the escape from the egg, and the consequent maturity of the chick at the time of hatching.

Let any one examine a patient in whom these movements are active in the latter months of pregnancy; he will find them both voluble and in considerable force. It seems as though the head of the child appeared suddenly at one part of the abdomen, and then as suddenly at another and most distant point; the limbs move about apparently from one end of the uterus to the other faster than the most experienced touch can follow them. Often it seems impossible to account for all the heads and limbs which seem to appear, on the supposition of a single fœtus, and the mother is confident of the presence of twins at least. The movements are sometimes of considerable force. If the hand be placed on the abdomen, it appears as if struck from within, as distinctly as the hand placed upon the chest is struck by the impulse of the heart in hypertrophy of this organ. I have known a case in which the abdomen was so prominent that a book could be placed upon it, and the book would be repeatedly struck off by the violent abdominal movements. Expectant mothers among the common people frequently talk of the child as turning somersaults in the womb. If all these movements were fœtal, there must and would, I consider, very often happen mischief to the cord, partial separation of the placenta, frequent mal-presentations, and other accidents.

The Emotions of the mother exert a considerable influence over these movements. I was some time ago in attendance on a lady in whom they were excessive, so much so as to disturb and alarm the mother, filling her with a dread of premature delivery; but a violent storm of thunder and lightning occurring in the night-time, they suddenly ceased. I mentioned this fact to an eminent obstetric physician, a friend of mine, the next day, and he informed me that in the same night he was called to a patient, in whom the alarm caused by the thunder-storm had excited such violent movements, that premature labour seemed to be imminent. During violent mental emotions on the part of the parent, the fœtus in utero has been supposed to be even affected with convulsions. I believe these phenomena, and such occurrences as those I have described, are much more easily explained by supposing it to be the uterus itself which causes the abdominal movements.

A very common plan is to place the cold hand, or the hand just taken out of cold water, upon the abdomen, with a view to excite the movements of the fœtus, for the purpose of diagnosis in suspected pregnancy. It is imagined that the fœtus is affected by the temperature of the external hand. When we consider, however, that the integuments and abdominal muscles, the uterus, the membranes, and the liquor amnii, all intervene betwixt the cold hand and the fœtus, it is rather too much to suppose that any direct thermometric influence can be exerted on the embryo by such means. A Reflex contraction of the uterus itself, from the application of cold to the abdomen, is readily comprehended; and no sound physiologist would think of giving any other solution to such movements, if the experiment were performed either during or soon after parturition. Why, then, accept such a different explanation of the movements of pregnancy?

If we carefully consider the condition of the child, we shall see that it is such as to render the profuse movements which are attributed to it quite incredible.

These movements are often felt, both by the medical attendant and the parent, at a time when subsequent events prove the child to have been dead; they have been felt by experienced accoucheurs, and living children diagnosticated in cases where the uterus has been distended by hydatids, a large collection of catamenial fluid, or by other causes. On the other hand, they have *not* been felt, and from this and other signs the child has been believed to be dead, and yet the child has been born alive and healthy.

We may frequently observe, after birth, even in cases in which there has been much abdominal movement, that the legs of the fœtus are across, and have indented each other; or the arms may be marked by contact with each other, or with the body; or there may be the distinct mark of the hand against the side of the head. These indentations are such as could only have been made by the long continuance of the fœtus in exactly the same position. Such facts are quite incompatible with frequent movements of the fœtus.

There is no relation whatever between the size and strength of the fœtus at birth and the amount of these movements during gestation; it often happens, that with a very small and stunted fœtus there has been almost perpetual abdominal movement; while with large and active children it may be very inconsiderable in amount. If the movements were fœtal, we should expect them to bear some proportion to the size of the fœtus at birth.

Again, what motor power is there which could possibly excite such, in some cases, almost perpetual motion of the fœtus. Volition, cerebral voluntary motion, is out of the question before respiration has taken place, and before the brain has been roused by arterial blood. Emotion is equally wanting. The reflex actions must be faint and obscure, for with the exception of the liquor amnii, the parietes of the uterus, and the contents of the fœtal intestine, the embryo is cautiously removed from all excitors of reflex action. The fluid medium in which the embryo swims, and its equable temperature, render external excitation very difficult, while the internal excitor surfaces are all in a state of the greatest possible repose.

The state of the fœtus in utero is peculiar: as regards the absence of volition it resembles deep sleep or cerebral paralysis, and it is comparable in some degree to the state of hybernation in animals, in which a very low degree of respiration and oxygenation of the blood is kept up. In all these states, the muscles, which are subject to voluntary regulation, contract from the principle which has been called muscular tone; the sphincters are all closed, and the flexor muscles, as the stronger, acquire a mastery over the extensors, so as to contract the limbs. The muscles of the fœtus are, I have no doubt, subject to this form of contraction, its final cause being to keep the fœtus in an ovoid shape, adapted to its retention within the uterus, and to its expulsion through the parturient passages at the time of birth. The hidden Phidias of the womb not only moulds each fibre and particle in the inward laboratory, but arranges the limbs according to the fashion best suited to their preservation during the embryo state, and their delivery at the appointed time of labour. The flexion of the limbs of the fœtus in utero is not merely a passive, but an active state; for even after birth, volition is a long time in acquiring the power of extending the limbs with precision. This is particularly the case with the lower extremities, to which the chief amount of fœtal movement is referred. Both before and after birth, the lower limbs are more contracted than the upper. There is a difference in the state of the circulation in the upper and lower extremities, the arms being supplied with blood more decidedly arterialized than the legs. This is probably a cause of the different condition of the muscles. Intimately connected with this state of the muscular system *in utero*, we have the various descriptions of congenital talipes or podrismus, and the other objects of orthopœdic surgery. These deformities are caused by excessive contraction of certain muscles, or relative contraction of these muscles from paralysis, or from feeble contraction in the muscles which should oppose them. Many cases may depend on excess of the tonic contraction of the muscles *in utero*. The preponderance of podrismus over cheirismus is remarkable; its connexion with the circulation and the normal contraction of the extremities cannot fail to strike the thoughtful observer. But the whole subject is one which deserves to be pursued separately, and as the disorder is congenital, its correct pathology must be based upon the study of the nervi-motor condition of the fœtus.

We may derive another series of evidences from what takes place in the anencephalic or amyelencephalic fœtus. These are facts which show that the abdominal movements or supposed motions of the fœtus take place just as much in the fœtus born without brain or spinal marrow, as in the perfect embryo. In September last I had an opportunity, by the kindness of Mr. Bluett, of St. John's Wood, of seeing a remarkable case of anencephalic birth, which occurred to a woman who had been delivered of a similar monster at a former labour. The brain was absent, but the supposed movements of the child had been distinctly felt during pregnancy. The mother in this case had borne numerous children, so that she could have perceived any difference in the movements, but she declared that there was no difference whatever. Here, then, could have been no cerebral or voluntary movements of the child, for there was none even after birth, the infant lying perfectly still, unless when excited to motion or convulsion by external stimulus. But there is a case placed on record by M. Lallemand, in which there was neither brain, spinal marrow, nor even the origins of any of the nerves, and yet the supposed movements of the fœtus were present! M. Lallemand says of this remarkable case, that the mother had dated the time of her quickening from the appearance of the supposed movements of the fœtus, and she had caused them to be felt by others, only a short time before her delivery. As it was not her first pregnancy, these facts are the more important. M. Lallemand's words are—

"Elle jugeait qu'elle était au huitième mois de sa grossesse par l'époque où elle avait commencé à sentir les mouvemens du fœtus. Deux jours avant d'accoucher elle faisait observer qu'elle les sentait encore distinctement, mais qu'ils étaient moins forts que dans les grossesses précédentes."

In this case, then, both brain and spinal marrow, the two great sources of voluntary and reflex motor action, were absent. If we suppose the movements felt by the mother to have been fœtal, we are reduced to the necessity of believing the ganglionic nerves to be sources of motor power in the limbs, a position which few would be found to uphold. I argue this question so much at length, because it is of real importance, and the difficulty of ascertaining the truth by manual examination is almost insuperable, unless we call reasoning and experimental observation to our aid.

There is another point well worthy of consideration. Dr. Marshall Hall has established, beyond all question, the law of the inverse proportion between respiration and muscular irritability in animals. In the human fœtus, the placental respiration, so to speak, is extremely low, and the irritability of the muscular fibre extremely high. Under such circumstances a great amount of excitation and motor action would exhaust and destroy the fœtus. I have already dwelt on the care with which the fœtus is protected from stimulus, and it is very certain that the fœtus would be speedily destroyed if it were subject to the constant motor action so often witnessed, for several months together, in pregnant women.

If we return our consideration from the embryo to the uterus, we are met by further evidence and reason for believing that it is to this organ, and not to the fœtus, that the abdominal motions are to be referred. The undulating, wave-like motion, proper to peristaltic action, can sometimes be seen upon the surface of the abdomen, and this can belong to no other organ save the uterus. It may be seen better than it can be felt by the accoucheur, as the hand cannot, like the eye, follow the movement as it passes from one side of the abdomen to the other, or from the epigastrium towards the pubis. The most distinguished obstetricians have felt, I repeat to you, what they have believed to be the movements of the child in cases where no child existed. In enlargement of the uterus from hydatids, or from retention of the catamenial secretion, they have been certain, according to the received ideas, that they have felt a living child move; it is most extraordinary that such facts should not have long ago led observers to seek for some other and more general cause of the abdominal movements of pregnancy than the limbs of the fœtus.

According to the prevailing ideas, we are called on to believe that the uterus, during the forty weeks in which it is developed into the largest muscle of the animal economy, remains during the whole period inert, and without contraction. Such a state of things would at once isolate the uterus from the rest of the muscular system. It is improbable.

It may be replied that there is an obvious reason why the uterus should remain quiet until the term of pregnancy has expired, inasmuch as its contents are not intended to be expelled until the expiration of that time. But this reasoning will not hold good; the peristaltic actions of the intestine, of the stomach and the bladder, are perfectly distinct from the acts of expulsion of these organs; the vermicular movement to which they are constantly liable by no means effects of itself the evacuation of their several contents.

If we consider the evidence respecting the actual perception and recognition of the limbs and different parts of the child by the taxis, we shall find it worth absolutely nothing; it has already been said that men skilled in diagnosis have declared that they had felt the child in cases where pregnancy had never existed. In cases where the child had been pronounced dead, from the cessation of abdominal movement, it has been born alive; and in other cases in which they have continued vigorously to the extreme term of gestation, a premature and putrid child has been born, which must have been dead *in utero* for a considerable time.

When mothers or accoucheurs have been positive about the existence of a fœtus *in utero*, on the evidence of supposed fœtal movements, and the event has proved that there was no fœtus at all, or that it had long been dead, the way of escape from a false opinion has been to refer the movements to the abdominal muscles, or to the colon. Sometimes the peristaltic movements of the intestines have been mistaken for the movements of pregnancy; at others, the motions have depended upon the developed uterus containing a dead child, or hydatids, or retained catamenia. That pseudo-prophetess, Joanna Southcott, in particular, was accused of simulating the movements of pregnancy by the abdominal muscles. But this celebrated virgin was very obese, and I do not believe such simulation possible under the circumstances, if at all. The movements must have been those of the stomach and intestines.

Altogether the facts I have gradually collected on this subject are conclusive to my mind as to the impossibility that the child can be the author of all, or even the majority, of the abdominal movements of utero-gestation, and as to the certainty that these movements really depend upon Peristaltic action of the uterus. The general fact, that when the child is dead, the abdominal tumour subsides, and the abdominal movements cease, admit of quite another explanation. The truth is, that the abdominal movements cease after the death of the ovum, because the circulation between the uterus and placenta ceases, the temperature of the fœtus falls, and the whole intra-uterine mass becomes a foreign body, exciting the uterus to uniform contraction, instead of the peristaltic actions of healthy pregnancy.

I have been thus careful in tracing the nature of the abdominal movements, in order that accoucheurs may estimate them at only their just value when pregnancy is suspected, and on occasions when the life or death of the child is an important element in deciding upon obstetric operations involving the safety of the mother and the child. If my opinions are correct, and I confidently believe them to be so, these movements ought never, as they have often done, to decide in future upon questions of life or death. We must ascertain the condition of the fœtus by auscultation, and not trust either to our own manipulations, or to the sensations of the mother.

Obstetricians are divided in opinion as to the real cause of the sensations observed by the mother at the time of Quickening, as it is called. Some believe the sensations of quickening depend on the appearance of the fundus uteri above the pubis; others refer them to the first movements of the fœtus; I have little doubt that they really depend upon the first peristaltic actions of the uterus, and that the date of quickening marks the time when the contractile tissue of the uterus is so far developed as to admit of these contractions. This term quickening, which it would be impossible to abolish too soon, is a relic of theo-physiology, absurd and groundless in itself, but upon which laws have been based that remain to the present day, to the disgrace of our jurisprudence. The imaginary quickening, marks the period when our ancestors believed the fœtus to become endued with life and soul. Women, therefore, who were quick with child, and convicted of capital crimes, were respited until after delivery. We now know that such a special commencement of human and immortal life has no foundation, and modern laws make it a punishable crime to procure abortion, and destroy the ovum at any time; but the ancient laws which sanction the execution of a pregnant woman, and her child with her, before the period of quickening, with their attendant absurdity of a jury of matrons, still survive. The law is therefore in this anomalous position: in one case, it punishes as a crime the destruction of the ovum in the early months; in the other, the Law itself ruthlessly commits this crime.

MANCHESTER MEDICAL SOCIETY

LECTURE VIII.

DIFFICULTIES ATTENDING THE INQUIRY INTO THE CAUSE OF LABOUR. —SEXUAL EXCITABILITY IN THE FROG.—CAUSE OF PARTURIENT ACTION IN OVIPAROUS FISHES; IN OVIPAROUS INSECTS; IN BIRDS; IN MAMMALIA; IN THE HUMAN FEMALE.—RELATION BETWEEN OVARIAN EXCITEMENT, SEXUAL EXCITEMENT, AND COITUS.—RELATION BETWEEN OVIPOSITION, ŒSTRUATION, MENSTRUATION, CONCEPTION, AND PARTURITION.—THE COLLECTIVE PHENOMENA OF OVI-EXPULSION; OBJECTIONS TO THE DISCOVERY; OBSTETRIC RESULTS.

Reflex physiology plays so important a part in the actions of the uterus during parturition, that it can excite no surprise if I assert that it is intimately concerned with the cause of the coming on of labour at the end of the 280 days which complete the term of natural pregnancy.

In 1842, while studying the more obvious reflex actions of parturition, the cause of the first contraction of the uterus met me as a barrier beyond which it seemed impossible to pass. The pious exclamation of Avicenna, "At the appointed time, labour comes on by the command of God," expresses his idea of the profoundness of the mystery, and his hopelessness of its solution. The words of the Arabian physician agree with the candid admission of a modern writer, Dr. Carpenter, that "we know nothing" of the reason why the period of parturition should be just forty weeks after conception. And, though hypotheses have been numberless, no intermediate author has given anything like a reasonable solution of the mystery in which this subject has always been involved. I began by steadily considering the first motor phenomenon of labour — namely, the equable contraction of the uterus which occurs before the actual pains of labour commence; endeavouring to understand the nature of this contraction, and why the uterus should acquire the special tendency to contract at this time in preference to any other. At first, I confess, I could see no excitor cause; I could only suppose that the premonitory contraction must depend on the irritability of the muscular tissue of the uterus itself. I further believed this irritability to be excited by the fœtus, acting after its full development, as a foreign body. But I soon found the insufficiency of such an explanation; and as all the other functions of egestion in the animal economy, and many of the particular actions of labour, are reflex in their nature, I felt impelled to look for some special excitor cause which should be adequate to set up the various reflex and other motor actions of parturition. The contractions of the uterus, which take place at the conclusion of the term of gestation in extra-uterine pregnancy, even when the ovum has been attached to the abdominal parietes, rendered it impossible that the cause of labour should be found in any reciprocal action between the fœtus and the parturient canal. The facts, often observed, that natural gestation is always a multiple of the catamenial period, and that abortions generally occur at what would, in the unimpregnated states, have been catamenial periods, led me by degrees to inquire whether the exciting cause of labour might not be detected in the ovaria. I gradually accumulated facts and observations to a sufficient extent to make me believe I had now obtained the clue to the discovery of the true Cause of Labour, and I determined to prosecute the subject, by examining the relation of ovarian excitement to the parturient processes in the different classes of animals. I must appeal to what follows to prove whether I have completed the task I thus proposed to myself; and whether I have been able, as I believe I have, to unfold the correct theory of Parturition, or Ovi-Expulsion, throughout the animal kingdom.

At the time of parturition, there is the *tendency* of the uterus to contract on the application of stimuli to be considered; besides this *tendency* or aptitude, there are the particular actions really excited by the stimulus of the fœtus, and other incidental stimuli. In any successful inquiry into the cause of labour, it must be necessary, at the threshold, to ascertain the cause of this first tendency to uterine contraction, after the organ has lain so nearly dormant during the whole time of utero-gestation. What, then, is the cause of this increased tendency to motor action; of the increased excitability, in other words, of the excito-motor arcs which preside over the parturient actions of the uterine system? This is the really important question. Let me attempt the answer.

Very early in the present inquiry, I saw that the cause of labour in the human female must also be the cause of all the parturient phenomena of the animal kingdom; and this set me to observe and deduce from the parturient actions of the lower animals, in order to explain those of the human subject. There are many animals I might choose as a base from whence to extend this research upwards, but I will select the frog, a creature which has been quaintly termed "Nature's gift to the physiologist." It is certainly more nearly related than any other animal to the most important discoveries in physiology, and it is admirably suited to the matter before us. In the male frog, then, (for we may consider both male and female,) the growth of the testes, in the winter and early spring months, alters the innervation of the animal in many important respects. In the autumn, all the limbs are flexible, the frog leaps and swims with the greatest alacrity; it exerts the most perfect voluntary control over all its locomotive organs. But as the growth of the testes proceeds, there may be observed, the development of the dark tubercles upon the thumbs of the anterior extremities, and the increase in the size of the muscles of the fore-limbs. There is now no longer perfect voluntary control of these muscles, but the two arms are closely flexed over the breast, in the manner often described by physiologists. This contraction of the arms occurs whether the animal be alone, or whether it embraces the female, or any other foreign body. The contraction of the arms is of a persistent and even tetanoid kind, continuing for many weeks, so long, indeed, as the testes remain in a state of increase and activity. Besides these phenomena, which are referrible solely to the testes, the whole of the surface of the body is excitable to an intense degree. The most excitor parts of the body are the tubercles, but when these are cut away, irritation of the inner surface of the forearms, and of the entire anterior surface, will still excite increased rigidity and contraction of the anterior limbs. The evident intention of these excito-motor phenomena is to enable the male to embrace the female during the prolonged descent of the ova through the oviduct, and the process of oviposition, which, taken together, last several weeks.

In the female frog, during the enlarged and active state of the ovaria, the muscles of the fore-limbs increase in size, the tubercles being absent; but instead of being *flexed*, as in the male, they are *extended*, though in the same rigid tetanoid manner, as if for the purpose of supporting the weight of the male, and raising the throat of the female herself out of the water; the natural site for the deposition of ova being near the edge of shallow waters. These motor actions are perfectly involuntary both in the male and the female, continuing after division of the cervical spinal marrow; indeed, they impede the voluntary movements, as the fore-limbs are quite useless in progression, from the amount of involuntary contraction which affects them. The wisdom of this arrangement is as evident as the mingled voluntary and reflex action in the flight of the bird; no merely voluntary movements could support these creatures in the proper position during their lengthened coïtus and oviposition. At the time of oviposition, in the latter end of March, or the beginning of April, frogs assemble in numbers on the banks of streams and shallow pools, when their white throats, tinged with red or yellow, give them, at a little distance, almost the appearance of water flowers. Their movements are so impeded by the circumstances I have named, that they may be collected in almost any quantity.

The motor condition, and the coïtus and oviposition of the toad, are very similar to the frog. During the great part of the sexual congress in both, the ova are traversing the oviduct; when the ova have reached the external aperture, and oviposition has commenced, the ova are expelled with great rapidity, being fecundated by the male after, or rather during, the moment of expulsion. The ova of the frog are deposited in masses; and the gelatinous matter in which they are involved swells by immersion in the water into hexagonal shapes, so that the arrangement of a mass of ova from the frog is almost as regular as the hexagons of the bee: in the toad, the ova are arranged in strings, the gelatinous matter being the medium of connexion, and when taken out of the water, the black ova hang together like the beads of a rosary.

I need hardly insist on the dependence of the motor phenomena of the fore-limbs of frogs on the development of the ovaria and testes. They all disappear with the shrinking of these organs in the summer, and they reappear with their enlargement in the winter and spring; they would not appear at all if the ovaria and testes were wanting.

These facts, then, which any one may observe in the reproduction of these animals, prove that the activity of the ovaria and testes produces a long-continued and involuntary contraction of certain muscles; and further, that they increase the excitability of the nervi-motor apparatus devoted to the function of reproduction. The latter is the fact I wish more particularly to use in the explanation of the higher forms of parturition.

You will remember that, in a former lecture, I begged your close attention to the persistent grasp of the ovaria by the Fallopian tubes, during the menstrual period, and that I referred to an analogy between the action of these tubes in menstruation,—the oviposition of the human female,—and the action of the fore-limbs of the frog in the oviposition of this meaner creature. I pointed out to you that during menstruation and œstruation in the mammalia, the tubes were in a state of persistent contraction, and that there was also an increased tendency to reflex contractions in these organs. You cannot now fail, as I think, to see the analogy most clearly. I believe, further, that at the time of parturition in mammalia, the uterus and the uterine nervous system are excited by the ovaria; that it is ovarian excitement which induces both the permanent contraction of the uterus immediately before the coming on of labour, and the tendency to those reflex, emotional, and peristaltic actions, by which parturition is completed. In menstruation, a small synergic and reflex arc is described between the ovaria and the Fallopian tubes; in parturition, a larger arc is in operation, extending from the ovaria to the uterus. According to my researches, the excitability of the uterine nervous system at parturition, upon the presence of which the due performance of this function depends, is caused by ovarian excitement. At the time of ordinary menstruation, the ovarian irritation which excites the contraction and rigidity of the Fallopian tubes is manifest. Throughout utero-gestation the ovarian excitement returns in a slight degree at each periodic date; but at the eleventh period after conception, (reckoning the last catamenial period inclusively,) the ovarian excitement returns in full force, and, as a consequence, the uterine excitability, and the uterine actions of labour begin.

But it is incumbent upon me that I should show you more in detail the connexion between ovarian excitement and parturient motor action. In animals in which the separate female organs of reproduction exist in their most simple form, as where the ovarium is a mere lamina, without any special duct, throwing off ova from its surface to be impregnated out of the body by the male, the ovarian excitement, the sexual passion, and the parturient actions, all proceed together; they are, in truth, one act, the ovarian excitement being the essential part of the process. Ascending in the animal scale, the function of reproduction becomes more divided. The separation of ova and the performance of the sexual function become in some measure distinct from each other, and the parturient actions become more complicated, consisting of a series of processes. Still the ovarian excitement remains in the higher animals, as the fundamental condition which produces all the other and apparently independent acts.

Thus, in oviparous fishes, where the ova are fecundated externally, while the female is depositing the ova, she is pursued by the male, the time of oviposition being the only period of sexual congress. In the salmon, for instance, one or two male fish will sport round the female, pressing against her sides, and fecundating the ova with milt, after their escape. In the frog and the toad, as I have already said, ovarian excitement, the sexual congress, and oviposition, all proceed together. The male embraces the female firmly, in the way I have described, fecundating the ova as they escape from the mouth of the oviduct. It is very interesting, too, to watch the process of oviposition in the salamander. Both varieties, the smooth and warty, proceed in the same manner, and their habits have been most minutely and carefully observed by Rusconi and by Mr. Higginbottom, of Nottingham; to the latter I am much indebted for sending me some living gravid specimens, when I did not know that they might be obtained in great plenty near London. In the water-newt, the gravid state or the development of ova occurs without the intervention of the male, and it is in the spring months, when the whole abdomen is distended with ova, that congress and oviposition take place. During the period of oviposition the male occasionally approaches the female, and after playing about her a short time, she remains stationary in the water, when the male, turning on his side, makes a sudden movement with his tail, like the lash of a whip, towards the female; at the same moment ejaculation takes place, and the ova are fecundated within the body of the female. After this, she seeks out a blade of grass, and deposits her egg upon it, carefully curling down the tip, so as to enclose and protect it. In the male salamander, the tail and the dorsal fringe are so developed during the sexual epoch, as to fit them for the lashing movement upon which the impregnation of the female depends. The lash is evidently an involuntary and reflex movement, occurring as a part of the sexual orgasm at the moment of ejaculation.

Among insects, the silkworm offers a forcible example of the connexion between sexual and ovarian excitement and the phenomena of oviposition. Let us take up the consideration of this curious and interesting insect at the time when the caterpillar is preparing for its change into the chrysalis.

The silkworm involving itself in its cocoon has often been compared by poets with the burial of the dead; physiology may find in it an image of life, and we may consider the cocoon as the analogue of the nest of the bird, or of the uterus of mammalia. In the higher animals, the ovum undergoes development in its natural receptacle within the body; in the bird, the process of nidification prepares a receptacle for receiving and developing the ovum externally to the body of the parent; but in the silkworm, after a certain period of independent, but still embryo life, the insect itself prepares the nidus or womb-like cell, in which to undergo its final transformation. Wrapped in this sphere, the metamorphosis slowly takes place. After the change from caterpillar to chrysalis, the chrysalis remains its allotted time in the cocoon, until, incited by the sexual passion, it wakens from torpor, and bursting the inner shell encasing its limbs, eats through the silken covering. Immediately on its escape, it rushes to the sexual congress, stamping its feet, and criq-criq-ing with its wings before the female in the most gallant and spirited manner, if we consider the size of the insect. The contact continues for several hours, and is attended with a constant and involuntary flapping action of the wings. Immediately on the withdrawal of the male, oviposition commences, and proceeds with great rapidity, the female often depositing upwards of a hundred eggs in the course of a few hours after her impregnation. If the females emerge from the cocoons before the males, they begin to deposit unimpregnated eggs, but slowly; if the males appear while the process of oviposition is going on, they approach the females in the ordinary manner, and after the congress is finished, oviposition is resumed, proceeding now much more rapidly than it did before impregnation. Thus the ovarian and sexual excitement are at once the cause of the birth of the parent insect from its cocoon, and of the oviposition which sends forth a new generation of ova. Impregnation and oviposition being completed, the insect dies away, in this climate, in a few days, as if these were the only essential functions of its perfect state. In the history of the ephemerides, the birth of the parent insect and the process of oviposition must be still more nearly connected.

In birds, the relation of ovarian and sexual excitement to oviposition is equally apparent. Our own Harvey, to whom I am proud of referring so often, compared the nest of the bird to the uterus, and he adverted to the fact, which to him was inexplicable, that the cock immediately bestows his favours upon the hen after her leaving the nest. The common hen, after laying, seems to call the cock by her noise, and he will prefer the parturient hen to any of the rest of his dames at this moment. The crowing of the cock is undoubtedly a sexual manifestation, and hens will sometimes drop their eggs, out of the nest, excited by the crowing of their mate. But I wish to dwell more particularly upon one fact—namely, that the favourite time for congress is immediately after the parturition of the hen. I have already mentioned my opinion of the analogy between the secretion of the shell of the egg, in birds, and the catamenial secretion. An important part of the uterine secretion of the bird is the pigmentary matter deposited on the large end of the egg of almost all birds, just before or during the time of oviposition. The beautiful spots and colours which decorate the eggs of birds in such infinite variety, are, viewed as a secretion, probably connected with salacity in the female bird, like the œstrual secretion of the mammalia; the coloured spots upon the eggs themselves doubtless excite her maternal cares and attentions, just as the plumage and song of the male excite the sexual emotions. After the completion of laying, and the suspension of the ovarian function, the sexual emotion disappears, and its place is taken by the maternal emotion. There can be little doubt but that, besides the beauty of their colour, the smoothness and warmth of the eggs, and subsequently of the young birds, impart pleasurable sensations to the inferior surface of the mother, and are a great aid or provocative to the instinct of incubation and maternal care. It is singular that in birds, and almost all the lower animals, it is the back which is the sexual surface of the female, while in the human subject the contrary obtains.

I now proceed to the mammalia, and we shall find the same phenomena grouped together with an unmistakable meaning. In many of the lower mammalia we may witness the processes of oviposition or œstruation, parturition, congress, and conception, all going on as nearly as possible at the same time. In the guinea-pig, for instance, immediately that the young are dropped, the female admits the male, conception takes place, and a new utero-gestation commences, dating from the very hour of parturition. There is, in these animals, œstruation and ovulation going on in the ovaria while parturition is taking place from the uterus; and during or immediately after the expulsion of the young, the sexual heat develops itself. The same phenomena are present in all the mammalia, in a greater or less degree. In those animals of which we know the order of the œstrual periods, as the rabbit, the horse, and cow, the duration of pregnancy is a multiple of an œstrual period. Doubtless this law is as extensive as periodic œstruation itself. Not only is gestation a multiple of the œstrual period, but the time of parturition is positively an œstrual period. The maturation of ova, which has ceased during utero-gestation, is resumed, and the sexual instinct is predominant, just as though the uterus did not contain the product of a former ovulation and conception. The presence of heat, or œstruation, in parturient animals, did not escape the observation of Harvey, though the fact has never hitherto been utilized in physiology. Speaking of the return of the human uterus to the unimpregnated size after delivery, he says,—

"In other animals the process is shorter and simpler; in them the parts concerned recover their ordinary bulk and consistence in one or two days. In fact, some, as the hare and rabbit, admit the buck, and again become fecundated, an hour after kindling. In like manner I have stated that the hen admits the cock immediately on laying."

These and other kindred facts are sufficient to prove that among the lower animals, the mother may be suckling one group of progeny while she carries another within her, which were conceived at the time of the birth of the first: nay, in the marsupialia there may be two series of embryos in process of development at the same time, the one hanging at the mammary glands in the marsupial pouch, the other conception remaining *in utero*.

Lastly, let us consider Human Parturition with reference to these ideas.

The duration of human pregnancy is well known to be a multiple of a catamenial period. It has been also observed, that in the rare cases, where the duration of pregnancy exceeds the ten menstrual periods, the function of parturition is deferred to the following period, so as to make pregnancy reach to eleven periods inclusive. This fact came out most clearly in the obstetric evidence on the Gardner peerage case, and will prove of very great importance in cases of supposed criminality in wedlock, or in establishing the legitimacy of posthumous children. On the other hand, it is well known, that when utero-gestation is brought to a premature termination, it is at what would have been a menstrual period that abortion usually takes place. There is, in fact, in all women, a tendency to abortion at the times represented by the catamenial periods. In placenta prævia, the hæmorrhage occurring in the later months of pregnancy generally happens at the periodic dates. Hæmorrhage sometimes occurs for two or three periods in succession before parturition in these cases, with perfect immunity in the intervals. The occurrence of uterine pains at the termination of the natural time of gestation, in cases of extra-uterine fœtation, points very decidedly to the operation of some extra-uterine source of excitement. After abortion,—and very speedily, too, in some cases,—it is known that there is a remarkable aptitude to conceive; and during the catamenial climacteric, when the ovaria are irregularly excited, there is frequently an increased tendency both to conception and to abortion. These accumulated facts are sufficient to establish the influence of the ovaria and of the ovarian function on the uterine phenomena of gestation and parturition. But to complete the evidence, we must inquire what proofs there are that the sexual excitement which attends exaltation of the ovarian irritability in the lower animals, is present in the human subject. An attentive observer will not fail to perceive the existence of this excitement, though in a rudimentary degree. I have insisted, in a former lecture, that there is an actual increase of the sexual emotion during, or immediately after, the catamenial periods. There are also distinct traces of sexual excitement in some cases of parturition. That they are not always present does not tell against my argument, because the reasons why they are not so present are, as we shall presently see, very evident. My own observation convinces me of the truth of the position, and I have obtained from some of the most distinguished obstetricians of the present day the admission, that sexual excitement is sometimes apparent during or after labour in a very high degree; indeed, cases of this kind may pass into erotomania after parturition; and cases of puerperal mania sometimes present this form of excitement as the most remarkable concomitant of the disease. We should be bound to speak the truth in any case; but it would be most offensive to all the best feelings of our nature to suppose sexual excitement present during ordinary cases of labour, and it would certainly interfere very much with the confidence now placed in the obstetric practitioner. But no such suspicion need be entertained. Happily, human emotions are very much under moral control, and in women, almost universally, the utmost retirédness is preserved in everything which relates to childbearing and the puerperal state.

Provident Nature has, moreover, specially exempted women from the dominion of all passion save that of maternity at the time of childbirth. I believe this exemption and moral superiority arises, in a very great degree, from the physical suffering of parturition. The natural throes deliver womankind from those emotions natural to the inferior animals. Here it is that we see more clearly than under any other circumstances, *the morality of pain*, and I cannot but consider women would dearly purchase relief from the bitter pangs of travail at the expense of descending to the condition of the brutes of the field. The pains of natural labour are hard to bear, though of late they have been most cruelly exaggerated by interested parties, but they ennoble the sufferer morally, and after the trial has passed, there comes the cry of her infant as a happy crown to the maternal martyrdom. I believe it to be right, and conducive to the safety both of the mother and her child, that women should, with all the alleviations we can offer, short of interfering with a physiological process and dethroning reason, endure the sorrow and the joy of travail. With our present knowledge, they can, as I sincerely believe, only escape the suffering at the risk of greater evils. On a former occasion I pointed out, that in women, to whom ether-vapour had been administered during parturition, the sexual orgasm had been substituted for their natural pains—an exchange which women of modesty would far more shrink from, than the liveliest agony. Under chloroform, too, I have been informed of instances in which the lying-in room has been defiled by the most painful and obscene conversation. There appears, therefore, apart from considerations of safety, to be a moral objection to the use of anæsthetic agents in natural labour—an objection which should unite against them all men who desire to uphold the respectability of the obstetric department; for most assuredly, the present kind of attendance could not continue if the facts were understood by parents and husbands, or by women themselves. The metamorphosis of the rites of Lucina into the orgies of Venus would be no real boon to woman, and it would probably degrade obstetricy into mere mid-wife practice.

However, passing by for the present the question of the propriety of inducing artificial anæsthesia or intoxication in labour, the facts revealed by the use of ether and chloroform, taken in connexion with others, prove that though hidden or quenched by reason, morality, and, above all, by pain, there still exists in human parturition ovarian irritation, and at least the traces of sexual excitement. The phenomena of human parturition are a confirmation rather than an exception to the law of the existence of ovarian and sexual stimulus during Ovi-Expulsion.

Let me now proceed with the argument, that parturition does not merely occur at what would otherwise be a menstrual period, but that parturition *is essentially a menstrual period.* This I have taught you before, and these same words I published years ago. The sanguineous appearance called the "show," which indicates the coming on of labour, is generally considered to be the result of the laceration of certain hypothetical vessels at the os uteri. I say, hypothetical, for they have never been seen. But I assure you there is no evidence of the reality of this explanation. The pure facts are, that when labour is about to be ushered in, the firm mucous plug, which has closed up the os uteri during the latter months of pregnancy, is loosened, and escapes from the vagina. This mucous discharge is tinged with blood. The patient herself will tell you, if you inquire, that this appearance is very much like the onset of a catamenial period. She, in fact, detects the coming on of labour by precisely the same signs as she would detect the reappearance of the menstrual secretion after ordinary amenorrhœa. The "show" and the casting off of the mucus I believe to be the result of a secretion, not the mere product of ruptured bloodvessels. The sanguineo-mucous appearance is often preserved throughout the whole process of parturition, just as much as we might expect an uterine secretion to be, considering that the mouth of the uterus is almost entirely blocked up by the advancing fœtus. It is, as we might expect, most abundant at the first dilatation of the os uteri, and when the dilatation is completed.

The sensations of quickening, which, as I have stated in a former lecture, appear to me to depend on the first movements of the uterus, generally occur at the twelfth, sixteenth, or twentieth week; most commonly at the sixteenth week. This, it will be seen at once, is at the date, respectively, of the third, fourth, or fifth, periodic nisus after conception. One fact not unusually observed at the time of conception, bears more particularly upon the present subject—namely, that quickening is often attended by a slight sanguineous show or discharge. It is certainly most extraordinary that the catamenial discharge, and the sanguineous shows of quickening and labour, should not long ago have been allied together as kindred phenomena. I cannot but fully believe the show of quickening, like that of parturition, to be catamenial in its nature.

After the completion of labour, the condition of the uterus must be considered under a double aspect: we must consider the state of that portion from which the placenta has been detached, and the state of the rest of the internal surface of the organ. At the time of the separation of the placenta, blood escapes in considerable quantity; subsequently, the contractions of the uterus prevent any escape of blood from this situation, and the placental site resembles, as was observed by Cruveilhier and others before him, a new-made wound. During the first few days after delivery, the rest of the uterine surface secretes the lochia. I have examined the internal surface of the uterus after death, and I have seen the whole of the internal surface of the uterus dyed with the sanguineous secretion. This would not be the case if it were produced by one circumscribed spot in the uterus; and it must be remembered, that the site of the placenta is considerably diminished in size when the uterus is contracted. The general time during which the lochia are tinged with blood is about the same as the flow of the catamenia. I consider the lochia to be only different from the catamenia by the admixture of the discharges from the placental site. Hitherto the nature of the lochial discharge has been hidden by exclusive attention to the placental separation. This has seemed to give a sufficient explanation of the post-partum phenomena, and none other has been looked for; but it is by no means adequate to account for the lochial flow which occurs in just the same manner after abortion, in the early months of pregnancy. I might adduce other reasons for believing that the lochia and catamenia are, with the difference just mentioned, identical. I have observed, in cases of abortion occurring at what would have been a catamenial period, that menstruation has appeared at the end of a lunar month from the abortion, as if it were dating itself from a simple menstruation. One series of facts, relating to the lochia and catamenia, made a particular impression on my mind. I attended in close succession three ladies: one of those was delivered of a still-born child; the other hired a wet-nurse from the birth; and the third always menstruated regularly during lactation. Here were three different circumstances under which menstruation occurred after parturition. In all these cases I observed that the catamenia appeared regularly just one month after delivery! Since that time I have often observed other cases of the same kind. Another singular fact I may mention. Some obstetric writers mention, with surprise, that those women who have suffered from dysmenorrhœa, before pregnancy, suffer severely from after-pains, even with their first children. This point is referred to in the valuable work just published by Drs. M'Clintock and Hardy, of Dublin. I scarcely need say how easy the explanation becomes, when we recognise the real analogies between menstruation and parturition, between the lochial and the catamenial discharges. During labour itself there is every indication that much of the physical pain of childbirth is attributable to the ovarian nerves.

I may now pass in review before you the entire subject of Ovi-Expulsion—a term I have adopted as well suited to express all the parturient actions of the different classes of animals, and here I may state that I make the claim of having discovered their nature and their true cause.

The simplest form in which the separate sexual organs of both sexes appear is that of a mere lamina, as in some fishes, and here the organ of the male and female are essentially alike. This fundamental form is a point from which two diverging lines proceed; at the extreme end of one of these lines, we have the generative organs of the human male; at the advanced point of the other, those of the human female. From the simple lamina, we ascend, by tube, duct, gland, and stroma, to the human testis and ovarium, with their various anatomical accessories. In the same way in physiology, from the simple elimination of the sexual product on the surface of the laminar testis or ovarium of the fish, one line of analogy stretches out to emissio seminis; the other, to the perfect act of parturition, in the human subject.

Our present business is to trace the differences and analogies between the acts of generative egestion in the female, advancing from the lower to the higher forms of this function. It will be found that, in the higher forms of ovi-expulsion, and even in human generation and parturition, the characteristics of the more primitive forms of parturition or ovi-expulsion are preserved. The different parts of the generative canal in the human female—the ovarium, Fallopian tube, uterus, and vagina—only combine to perform, in a more elaborate manner, the same function as that belonging to the lamina, or the simple duct. There is one type in the physiology of the generative canal in the female of all oviparous, ovo-viviparous, and viviparous animals, which type is, the periodical return of the sexual passion and the acts of generation. In many insects, fishes, amphibia, and mammalia, the periodic return is annual; in others, and especially those brought under the influence of civilization, the return is at shorter intervals; in the human female it is lunar. In the lower animals the sexual passion is closely allied to the periods of ovulation, and it exists at no other times; and in all animals there is a distinct trace of this alliance visible in the increase of the sexual appetite with the maturation and dehiscence of ovules. There is a strict analogy between all the acts of all the female generative organs—namely, coïtus, œstruation, menstruation, conception, and parturition. Coïtus and the sexual orgasm are merely incitements to the fruitful performance of the other acts of generation. The rest—œstruation, oviposition, menstruation, conception, and parturition—are only so many varieties of fertile or unfertile ovi-expulsion, and are convertible one into the other. There are three forms of ovi-expulsion—the first, that in which the ovule is expelled unimpregnated, as in the oviparous fishes; the second, in which the ovule is expelled in the impregnated state, as in the case of the triton; the third, in which the ovule is both impregnated and partially or entirely developed before its extrusion, as in ovo-viviparous and viviparous animals. To one or other of these heads all the acts of ovi-expulsion may be referred. In some animals, all these forms of ovi-expulsion may be observed; in others, one or more can be distinguished. Thus the unimpregnated oviposition of fishes is similar to the oviposition of the virgin pullet; it is also analogous to œstruation without congress in the lower mammalia, and to menstruation without impregnation in the human female. The impregnated oviposition of the salamander and of the bird; the act of conception in the mammalia and in the human female, are essentially the same, only that the sexual product, the fertilized ovule, is differently deposited in each; in the one the blade of grass, in the other the nest, and in the rest the uterus is the receptacle, according to the different organization of the sexual canal in the different animals. Ovarian excitement is essentially the cause of all the acts of ovi-expulsion of the female generative organs. This obstetric dogma I would especially insist upon. The great body of facts and observations I have marshalled before you in the present lecture demonstrate most unequivocally to my mind, that in all animals which deposit ova for fecundation out of the body, the ovaria supply the stimulus to the motor actions necessary to their expulsion; next, that in those which expel impregnated ova, after they have remained a short time in the generative receptacle, it is a return of the same kind of ovarian excitement which conveyed the ovule from the ovarium to the receptacle that ultimately causes its expulsion; and lastly, that when the ovum is expelled as a mature embryo it is still ovarian excitement, at the return of an ovarian period, which brings about its delivery from the uterus. Under this point of view, the dehiscence of an ovule from the most simple ovarium is analogous to the complex function of human parturition. Unimpregnated oviposition is, as we have seen, performed by all animals without the access of the male, though oviposition is performed more energetically and regularly from the stimulus of coïtus, even when impregnation does not take place. Coïtus and conception, then, are accessories to oviposition, which is the fundamental generative act of the female. Menstruation and œstruation, and the descent of unimpregnated ovules through the Fallopian tubes, in mammalia, represent the whole process of parturition in the frog or the salmon. Conception and the deposition of the impregnated ovule in the human uterus represents the whole function of fertile parturition in the bird. In the parturition of viviparous animals, the conduction of the ovum from the uterus to delivery, is only another stage of the same process which conveyed the impregnated ovule from the ovarium to the uterus. In the dehiscence of ovules from the simplest ovarium, the nervous endowments of the organ are in an excited state, and promote the process of ovulation; in the conduction of ovules, whether impregnated or unimpregnated, from the ovarium through the oviduct, whether it be the simple oviduct of the amphibia or the compound oviduct of the mammalia, the nervi-motor actions necessary to the process are excited by the nerves of the ovaria; and when the lower part of the generative canal is finally roused to action at the time of parturition, for the expulsion of the developed ovum, it is still the ovarian excitement, which, acting in the modes I have endeavoured to explain, rouses the utero-vaginal portions of the canal to energetic action.

Where the ovarium is anatomically severed from the rest of the sexual apparatus, as in the mammalia and the human female, the ovarium is connected with the rest of the parturient canal by a series of reflex arcs. By means of the spinal excitor nerves of the ovaria, that portion of the spinal centre which presides over the actions of the uterus is, at the end of utero-gestation, thrown into a state of excitability or polarity somewhat resembling the general spinal excitability of tetanus. It is curious that at this time, besides the ovarian excitement of the catamenial period, which ushers in parturition, there is, upon the surface of the ovarium, the cicatrix (corpus luteum) left by the ovarian phenomena of conception, but which speedily disappears after delivery. The uterine nervi-motor system being thrown into such a state of persistent excitability that the uterus firmly contracts equably upon its contents, the fœtus itself, hitherto defended by the liquor amnii, becomes an ordinary excitor, and the reflex actions of labour are gradually established. The equable contraction of the uterus preceding labour is, in effect, just as though the membranes had been punctured in the operation of inducing premature delivery, and the head of the fœtus brought to exert pressure upon the os and cervix uteri.

Thus far I have attempted to trace the law which governs the distribution of the unimpregnated egg or ovule, and the impregnated ovum, in all animals; and I believe I have proved that OVARIAN EXCITEMENT IS THE LAW OF PARTURITION IN ALL ITS FORMS OF OVI-EXPULSION. Having attempted this, it may seem sufficiently obvious, but, at least, no one had done it before me. When Columbus wished to typify the simplicity of original discovery, he is well known to have proposed to his companions that they should try to set an egg upright upon the table, and, on their relinquishing the attempt, he set it up himself by crushing the point. Placing the egg of fact upright may seem, when the way has been shown, as easy as the setting up of the egg of figure; but, in this respect, however humble the attempt may be, it is only similar to other interpretations of Nature.

Let me now attempt to anticipate some of the objections which may be urged to the Law of Ovi-Expulsion which I have endeavoured to establish, and which includes the discovery of the Cause of Labour in the human subject; for I can hardly hope to have made the matter so clear that no objection may be urged. Probably some may say that I do not advance beyond the teaching of Harvey, Professor Naegelé, Dr. Rigby, and M. Berthold, all of whom have insisted on the fact that the duration of pregnancy is a multiple of a menstrual period, and some of whom have believed that it is the return of the menstrual nisus, or effort, which produces labour. No one has stated the fact that pregnancy is a multiple of the catamenial period more distinctly than the illustrious author of the "Exercitations," and I cannot do better than quote his words:—

"Prudent matrons, calculating after this rule, as long as they note the day of the month in which the catamenia usually appear, are rarely out of their reckoning; but after ten lunar months have elapsed, fall in labour, aud reap the fruit of their womb the very day on which the catamenia would have appeared had impregnation not taken place."

This, it will be seen at a glance, is merely the clear expression of a numerical fact, one which must have struck the earliest observers. It does not stand in connexion with any reasoning or induction, and it still left men to frame a thousand vain theories as to the cause of the action of the uterus at this particular epoch.

The greatest advance beyond the simply numerical idea with which I am acquainted, is contained in the writings of Dr. Rigby. This physician states, that fourteen years ago he surmised that "the reason why labour usually terminates pregnancy at the fortieth week, is from the recurrence of a menstrual period at a time during pregnancy, when the uterus, from its distention and weight of its contents, is no longer able to bear that increase of irritability which accompanies these periods without being excited to throw off the ovum." This view of the subject is insisted on by Dr. Rigby in his "System of Midwifery," published four years ago; but by catamenial excitement he expresses merely the uterine excitement of the periods, without any reference to its ovarian cause. He does not even recognise the analogy between menstruation and œstruation; and indeed he expressly objects to any comparison between the duration of human and comparative pregnancy in the concluding paragraph of his chapter on this subject. Dr. Rigby there observes, that "the valuable facts collected by M. Tessier respecting the variable duration of pregnancy in animals, which have been quoted by some authors in proof of the *partus serotinus*, are scarcely applicable to this question in the human subject: the absence of menstruation, and the different structure of the uterus, prevent our making any close comparison." So far from this being the case, I contend that a comparison between human and comparative parturition, and all the other forms of parturient action, is essentially and absolutely necessary to a comprehension of this branch of human physiology. Dr. Rigby's words convey precisely the same meaning as those of Denman when he urged, as an objection to the old surmise, which made labour depend upon "the effort to menstruate," that "it would not be judging according to any philosophical rule to attribute as the immediate cause of parturition, at any certain time, a circumstance peculiar to any individual class of animals."

The same author (Denman) remarks, "How far the discovery of the particular cause of the birth of a child might lead to the improvement of practice it is impossible to determine." One improvement I may suggest as very obvious. It will enforce and dignify the Excito-Motor Idea. Mechanical principles must take their proper and subordinate position, and the instauration of the excito-motor principle by the discovery of the cause of labour, must cause it to pervade the whole obstetric art, giving this hitherto humble department, as I believe, a truer and sounder basis than either medicine or surgery can at present boast. I do not wish to underrate or discredit mere mechanism, but I do say that the diffusion of a knowledge of the motor phenomena of labour, from the first muscular contraction to the last, must render it difficult for any one to agree with a living authority of considerable note, when he says, that the mechanism of labour is "the basis upon which the principles of practical midwifery should be founded." The prosecution of the motor idea, in the front of which the discovery of the cause of labour must stand, cannot fail to be thus productive of immense good. This will be evident, if we consider that uterine inertia, precipitate labour, ruptures and lacerations, sterility, the various forms of hæmorrhage, inversio uteri, abortion, puerperal convulsions, and many other grave accidents of pregnancy and parturition, are all essentially nervi-motor in their pathology and treatment. I have here no further remark to make, except that the discovery of the CAUSE OF LABOUR is one of the fruits of the discovery of THE SPINAL SYSTEM.

LECTURE IX.

ABORTION A BRANCH OF SPINAL PATHOLOGY.—EX-CENTRIC CAUSES OF ABORTION.—IRRITATION OF THE MAMMARY, TRIFACIAL, VESICAL, OVARIAN, RECTAL, VAGINAL, AND UTERINE NERVES.—CENTRIC CAUSES OF ABORTION.—BLOOD-POISONS.—THE EXANTHEMATA, SYPHILIS, SCROFULA, MERCURIALIZATION, CARBONIC ACID, SPECIFIC UTERINE EXCITANTS.—EMOTION.—MECHANISM OF ABORTION.

Irritation of the extremities of Excitor Nerves, and irritation of the Spinal Centre, are the *two Classes of Causes*, which must be studied in all their forms and varieties, in order to obtain a knowledge of the true nature of Abortion. In this subject we deal only with surface-pathology, unless we recognise the paramount influence of the nervous system.

EX-CENTRIC CAUSES OF ABORTION.

1. Irritation of the *Mammary nerves* may produce abortion. This cause is seen in operation in cases of undue lactation, complicated with a second pregnancy. Cases occur in which, during prolonged lactation, two or three conceptions and abortions follow each other, the latter being caused by the irritation of constant suckling. The question naturally suggests itself,—whether it is not the constitutional debility, rather than the local irritation, which induces abortion in these cases; and there can be no doubt that this, like many other anæmic conditions, may help to produce the accident. There is, however, over and above this, mammary irritation as a distinct cause. I have observed cases in which, owing to the synergic action between the uterus and the breasts, the

secretion of milk had been almost entirely arrested by conception—the infant being chiefly supported by feeding. The child would still suck most vigorously, in its attempts to obtain milk, until the uterus was excited to the expulsion of the ovum; and after the abortion has occurred, the secretion of milk returns abundantly. Such cases are very different from those in which the breasts are dried up from debility. If the synergic relations between the mammæ and the uterus required any more obvious proof, I might refer to cases on record in which actual metritis has been caused by the application of sinapisms to the breasts in amenorrhœa. It is important to recognise mammary irritation as a cause of abortion in the early months, because it may be mistaken for a copious menstruation; and the woman, misled by the subsequent profusion of milk, may allow of its recurrence, and so suffer considerable constitutional injury. It is curious that irritation of the stomach, between which and the uterus there is such a distinct relation, should *not* produce abortion. After parturition, the slightest gastric irritation will excite contractions of the uterus; but during pregnancy, gastric irritation, and sickness, even to death, may occur without disturbing the fœtus *in utero;* on the contrary, sickness seems positively favourable to the continuance of utero-gestation. The synergies between the lungs and the uterus are equally remarkable. The uterine phenomena of utero-gestation retard the progress of pulmonary disease, but if the most extensive disease of the lungs exist, it does not excite abortion. An amount of pulmonary disease sufficient to cause death a few days after delivery may be present, without any interruption to the natural duration of pregnancy.

2. Irritation of the *Trifacial nerve* seems, in rare cases, to excite abortion. It happens when no cause can be recognised but the appearance of the dens sapientiæ, and this phase of dentition is known to produce considerable local and constitutional disturbance. General convulsions may, in fact, be excited from this source, either in the male or female subject. The reflexion of irritation from the trifacial upon the uterine nerves, in young pregnant women, is no more remarkable than the strangury excited by teething in the infant. Extraction of decayed teeth during pregnancy is another cause of

abortion in which the trifacial is concerned. There is a well-known synergy between the uterine system and the teeth during pregnancy, leading to toothach and caries; and there is also a tendency to reflex action in the direction *from* the teeth *to* the uterus. These facts and their rationale require to be borne in mind in the management of pregnancy.

3. Irritation of the *Vesical nerves* is, in rare instances, a cause of abortion, as when patients conceive who are the subjects of chronic vesical irritation, or when there is stone in the bladder. The uterus itself reflects irritation upon the bladder during pregnancy, so as to exaggerate the effects of any primary vesical irritation which may exist.

4. Irritation of the *Ovarian nerves* is a very frequent and important cause of abortion. It is a well recognised fact, and one upon which I have often had occasion to dwell, that the majority of cases of abortion occur at what would have been menstrual periods. In such cases it is the ovarian nisus, and the attendant irritation of the ovarian nerves, either alone or combined with other causes, which excite the uterus to expel the ovum. The ovarian excitor nerves act in such cases just in the same way as they act in bringing on natural labour at the completion of the full term of pregnancy. Almost all women can perceive the menstrual periods as they pass through utero-gestation, particularly at the first three or four periodic dates. Those who have suffered from menorrhagia or dysmenorrhœa, or in whom organic ovarian disease has existed before conception, recognise the menstrual nisus most clearly, and it is precisely in these subjects that abortion is most likely to happen. Abortion in the early months is common during the grand catamenial climacteric; it constitutes, in fact, one of the chief dangers of this epoch. In all cases of abortion caused by irritation of the ovarian excitor nerves, the most common time for the occurrence of the accident is at the second, third, or fourth periods, but it may happen at any one of the periods. In cases where the abortion depends upon irritation of other excitor nerves, or upon erythismus of the spinal centre, the periodic ovarian irritation often determines the time of the accident.

5. Irritation of the *Rectal nerves* is a common cause of abortion. This variety of abortion is obvious when the accident

occurs from hæmorrhoids, or from operations for their removal; the presence of ascarides in the rectum; from the employment of irritating purgatives, particularly aloes, in excess, or the use of irritant enemata, or from the occurrence of severe diarrhœa or dysentery during pregnancy: obstinate and long continued constipation, or any other great irritation of the lower bowel and its excitor nerves, may also occasion abortion.

6. Irritation of the *Vaginal nerves* sometimes excites abortion. Plugging the vagina is one of the means resorted to for the artificial induction of premature expulsion; the mechanical irritation of coïtus will sometimes produce abortion, and this cause must be divided between the os uteri and the vagina. In cases of threatened abortion with hæmorrhage, the danger of the accident is sometimes increased by the plugging of the vagina resorted to in order to arrest the loss of blood. This fact should always be borne in mind when the plug is resorted to in hæmorrhage of any kind occurring during utero-gestation. It is possible that in arresting the hæmorrhage we may ourselves cause abortion.

7. Irritation of the *Uterine nerves* is, beyond doubt, the most important of all the causes of abortion. Abortion may occur without any other apparent disorder of the ovum or the uterus, except an absence in the uterus of the proper disposition to growth or development. The uterus will grow to a certain size, and then an arrest of development appears to take place, which ends in the expulsion of the ovum. In other cases, the fœtus dies, and becomes a foreign body, directly irritating the uterus to throw off its contents. This cause of labour involves the whole subject of intrauterine pathology, and all disordered conditions of the fœtus, membranes, and placenta. The separation of the membranes from the walls of the uterus, and the effusion of blood, or disease of the placenta, are important causes of abortion. Puncturing the membranes, and bringing the fœtus in direct contact with the parietes of the uterus by the evacuation of the liquor amnii, will excite abortion in the same manner. In the abortion excited by violent horse or carriage exercise, the accident depends on the mechanical irritation of the os and cervix by the fœtal head, in consequence of the succussion. In principle, the

abortion caused by equestrian or carriage exercise is precisely the same as the oviposition excited in the tipula or libellula, by shaking these insects upon rough paper. Irritation of the os uteri by coïtus; the use of the plug; vascular irritation and inflammation; and ulceration of the os and cervix, will, if continued, excite reflex actions of the uterus, terminating in the loss of the ovum. The uterine versions are also causes of abortion. Another uterine source of abortion is the implantation of the placenta over the os and cervix uteri. The presence of the placenta in this abnormal situation excites the uterus from within, in the same manner as the plug from without; hence the frequency with which placenta-prævia cases terminate in premature delivery. When speaking of ovarian irritation as a cause of abortion, I mentioned that this danger was chiefly incurred during the early months of pregnancy. In placenta prævia, on the contrary, owing to the greater development of the placenta, and the anatomical changes occurring in the os and cervix uteri as pregnancy advances, the danger of abortion increases with the advance of pregnancy. Different tumours, malignant or non-malignant, attached to the os and cervix, or to the parietes of the uterus, when they excite abortion, act after the same manner. To the long list of uterine irritations issuing in abortion, I may add injuries of the uterus itself from external violence, and inflammatory disease of the uterine tissues.

All these causes, it should be observed, whether vaginal, mammary, vesical, rectal, facial, or uterine, are purely excito-motor in their operation. The irritation is applied *to* the excitor nerves, and reflected *through* the spinal marrow *upon* the motor nerves and the uterus. It often occurs that two or more causes are in operation at the same time. The reflex contractions of the uterus which constitute abortion are not excited, as in the case of respiration or vomiting immediately on the application of stimuli. If cold water be thrown upon the breast, the movements of inspiration—if the fauces are irritated, the movements of vomiting—are instantly produced. But it is not thus in the case of the uterus. Though this organ is so distinctly under the control of the spinal marrow during and immediately after labour, so distinctly, indeed, that merely asperging the abdominal surface with cold water soon after delivery produces instantaneous uterine contractions, yet, during pregnancy, no reflex actions sufficient to cause abortion follow immediately upon the application of the ordinary stimuli of excito-motor action. It requires that the nervous arcs in relation with the uterus should be irritated for a considerable time, and an excitable or charged state of the uterine nervous system is then produced, during which reflex actions are readily excited by slight causes.

The nervous arcs presiding over parturition are, to a certain extent, isolated from the rest of the spinal system. If it were not so, and if the uterus immediately obeyed an excitor stimulus, like the stomach, or the respiratory muscles, abortion would be the rule, normal parturition the exception. There are certain facts which show this independence of the nervi-motor apparatus of ovi-expulsion in a remarkable manner. I may mention one fact and one experiment, both of which I owe to Dr. Marshall Hall. Dupuytren relates the case of a woman who became the subject of traumatic tetanus during her pregnancy, but who nevertheless, recovering from the tetanus, passed on to the end of utero-gestation without aborting. A frog taken during the time the oviduct was full of ova, was rendered tetanic by strychnia for a considerable time: the ova were not expelled during the presence of the tetanoid symptoms, but several days afterwards, when they had entirely disappeared, oviposition took place in the ordinary way. It is well known how difficult it is to induce uterine contractions with the ergot of rye before the time of parturition, though this agent has a special action upon the nervi-motor actions of the uterus. All these facts prove the independence and seclusion of the nervi-motor apparatus of ovi-expulsion, until the appearance of the exciting causes of labour. When this epoch has arrived, or when the excitability of the uterine nervous system is roused, as in cases of abortion, the ready answer of the uterus to stimuli is as remarkable as was its previous indifference.

All the excito-motor causes of abortion are, in fact, imitations of the ovario-excitor cause of natural parturition at the end of utero-gestation, only in many cases, instead of the ovarian nerves being the inducers of the uterine nervous excitability which terminates in premature expulsion, it is the mammary, vaginal, rectal, &c. In the instances where ovarian irritation is the cause of abortion, the cause of abortion is precisely the same, and acts in the same manner, as the cause of natural labour, the only difference being that of *time*. I have said that oftentimes more than one cause of abortion is in operation; thus uterine irritation may produce the irritability or excitability of the uterine nervous system, but before this irritability has actually produced expulsion, irritation of the rectum may step in and complete the abortion. One point I would insist on most emphatically—namely, that in cases of vesical irritation, or rectal irritation, we cannot correctly talk of the extension of nervous irritation from these organs to the uterus, by structural contiguity and continuity, or because they are supplied by nerves from the same source. Vascular phenomena may so extend from one organ to another in the same vicinity, but nervi-motor phenomena never can do so. There are abundant vascular anastomoses to account for such extensions of vascular phenomena, but there are no anastomoses of the nervous fibrils. However close the irritation may be to the motor organ, all the motor action which does not depend upon irritation of the muscular fibre, or upon sensation or emotion, is reflex in its form. The uterine contractions of abortion caused by irritation of the rectum and bladder—nay, even of the uterus itself—is as truly reflex and spinal as the uterine contractions excited by trifacial, gastric, or mammary irritation. I insist on this point, because I frequently observe relaters of cases speaking of motor sympathies between the bladder, uterus, and rectum, as though there were some short cut between these organs, whereas there is no motor connexion or route whatever, except it be *through* the spinal centre, and by way of the excitor and motor nerves. In all, there is the excitor nerve, the spinal centre, and the reflex motor nerve concerned; at one end of the nervous arc there is the physical irritation, at the other, the motor contraction. As in other cases of excito-motor action, sensation may be present, but it is by no means essential. Physical irritation of the excitor surfaces, short of sensation or pain, may produce the entire phenomena of abortion.

This is one of the facts which renders the due recognition of all the excito-motor causes of abortion so essential to the prevention and treatment of this accident.

We may look on abortion as, in some points of view, comparable with spasmodic asthma, or any other excito-motor disease. From some irritating cause, an excitable condition of the excito-motor arcs presiding over parturition is induced, just as in the case of asthma, where it is the respiratory nervous arcs which are rendered excitable. This state of excitability once induced, slight causes of irritation, which in healthy subjects would produce no disturbance whatever, are sufficient to produce, in the one case, spasmodic respiration; in the other, morbid or spasmodic parturition. Besides the ordinary periodicity of abortion—namely, the tendency to premature expulsion at the catamenial dates, there is another remarkable periodicity observable in abortion, in the tendency to the occurrence of miscarriage in successive pregnancies at a particular time. It often happens that we may see in these cases the obvious physical cause of abortion developed at the special times; but in others there seems to be a habit, or predisposition, the nature of which we cannot so well understand.

CENTRIC CAUSES OF ABORTION.

But besides the causes of abortion involved in physical irritation of spinal excitor nerves, there are other causes in which the circulation of the blood, and the *Spinal Centre*, are chiefly concerned. There are certain erythematic conditions of the system in which abortion is very prone to occur. These are, the exanthemata, particularly small-pox and syphilis, in each of which a special poison is introduced into the blood; the pyrectic state of the system which obtains at the commencement of the non-specific fevers and simple inflammations of the viscera is attended with similar danger; the scrofulous diathesis, too, has been considered as prolific of abortion as the syphilitic; but, I believe, with far less justice. The inhalation of carbonic acid rapidly excites abortion, and during accidental or intentional poisoning by this gas the ovum is often found expelled. During the celebrated razzia in Algeria, in which a great number of Arab women were suffocated in the caverns of Dahra, those of them who were pregnant were found to have aborted. Military histories offer examples of the same kind in other countries. I believe the retention of noxious elements in the blood, in the albuminuria of pregnancy, to be a cause of abortion as well as of puerperal convulsions. There are also certain specific agents, as the essential oil of savin and the ergot of rye, which, if persisted in, are adequate to cause abortion; and lastly, all the agents recognised in toxicology may cause abortion, as well as the destruction of the parent, when administered during pregnancy. In all these instances the blood is the medium by which the exciting agent is conveyed to the spinal centre. They are precisely similar to the artificial abortion which may be excited in the lower animals by direct mechanical irritation of the spinal marrow.

Another important cause of abortion, acting through the spinal centre, is *Emotion*. This cause, unlike those causes which reach the spinal centre by the blood, is purely *psychical* in its nature. The influence of emotion in exciting the uterus to evacuate its contents is as undoubted as the influence of emotion upon the stomach or upon the rectal and vaginal sphincters. But just as in the case of uterine excito-motor action, ordinary emotion does not affect the uterus instantaneously. Time is generally required for its effects to develop themselves into uterine excitability. The rapidity with which emotion affects the uterus is proportionate to the intensity of the emotion. A violent fit of anger, serious fright, or intense grief, may lead to abortion a few days after the violence of the emotion has disappeared. In other cases uterine action follows almost immediately upon the emotional excitement. During religious persecutions women have aborted suddenly at the stake; and here the emotion produced by excessive terror would probably be the chief cause of the accident. Thus emotion may, under very extreme circumstances, act upon the uterus, and produce abortion, even more readily than ordinary excito-motor causes.

In the history of abortion, there has been a too general tendency to attribute the accident to some particular and almost universal cause. For instance, at one time abortion is referred almost exclusively to disease of the ovum; at another, to the strumous diathesis; at another, to disease of the os uteri: on this latter point I would wish to be understood as not undervaluing the researches of Dr. Henry Bennet, and Mr. Whitehead of Manchester; but I contend that the study and recognition of ALL the manifold causes of abortion is necessary to the student and the successful practitioner.

The mechanism by which abortion, or the premature expulsion of the ovum, is effected, varies considerably, according to the time, between conception and natural parturition, at which the accident occurs. When the impregnated ovum is lost immediately after conception, the phenomena are very similar to the menstrual period; when the abortion occurs in the latter months of utero-gestation, it resembles natural parturition. In abortion at various intervals between conception and parturition, the nearer it is to the time of conception, the more it appears like menstruation; the nearer it is to parturition, the more closely is it imitative of that process. In the earliest abortions, where conception has preceded a menstrual period, the motor actions of expulsion are chiefly confined to the Fallopian tubes; there is little motor action of the uterus, either of dilatation or contraction, the ovum being washed away by the menstrual fluid. An exception must, however, be made in the case of women who have borne several children, in whom the uterus is sometimes a contractile organ, even during menstruation. Usually the uterus does not contract with any force during the first two or three months, or abortion would probably be far more frequent than it is. Abortion at this time is rather a mechanical dislodgment, by the separation of the ovum from the uterine parietes, than a distinct motor act of expulsion. After the ovum, becoming separated from the uterus, has entered the vagina, it excites expulsive action of the abdominal muscles, similar to those of micturition and defecation. When quickening, or the first peristaltic movement of the uterus, has occurred, the uterus dilates and contracts as in natural parturition, only less perfectly; and abortion becomes gradually divisible into the different stages of natural parturition. There is the dilatation of the os uteri, the distinct contraction of the uterus at intervals, or in pains, and the bearing-down, or expiratory actions which expel the ovum from the vagina. The condition in which the ovum is expelled varies also according to the time at which it takes place; in the early months the ovum is expelled entire, except when decomposition has taken place, the fœtus being involved in the membranes; but as utero-gestation advances, the membranes are often ruptured during expulsion, as in natural labour, and the fœtus and secundines discharged separately.

MANCHESTER MEDICAL SOCIETY

LECTURE X.

THE PROPHYLAXIS OR PREVENTION OF ABORTION.—PREVENTIVE MEASURES RELATING THERETO — I. MAMMARY IRRITATION; II. DENTAL IRRITATION; III. VESICAL IRRITATION; IV. OVARIAN IRRITATION; V. RECTAL IRRITATION; VI. VAGINAL IRRITATION; VII. UTERINE IRRITATION. UTERINE, PLACENTAL, AND FŒTAL DISEASE. RESPIRATION OF THE FŒTUS. INTRA - UTERINE PATHOLOGY. PREVENTION OF ABORTION FROM HABIT. EPIDEMIC ABORTION; HÆMORRHAGE IN ABORTION; TREATMENT OF ABORTION. ERADICATION OF THE ABORTIVE DIATHESIS. TREATMENT OF THE UTERO-SPINAL AXIS. SEDATIVES OF PREGNANCY.

Careful and minute attention to all the various causes of abortion is the true basis of preventive measures. In the prophylaxis of abortion, I propose to follow the order I have already observed in treating of its causes; dealing with the palliation or removal, in the first place, of the Ex-centric, in the second, of the Centric, causes of this accident. I now use the word abortion in its largest sense, including every variety of premature expulsion of the impregnated ovum.

I. With reference to Mammary irritation, it is hardly necessary to observe that weaning ought always to take place as soon as the occurrence of pregnancy during lactation becomes evident. Gestation and lactation ought never to be permitted to go on at the same time in the same individual, or the infant at the breast and the child in the womb must mutually suffer. After weaning, mammary irritation is at once removed, and instead of the exhausting and abnormal irritation in the direction *from* the breasts *to* the uterus, there comes into peration that healthful and physiological stimulus or synergic action *from* the uterus *to* the breasts, which prepares them for the new lactation when the fœtus in utero shall have arrived at maturity.

II. With respect to Dental irritation, it is just necessary to bear in mind that this is occasionally, and in rare instances, a source of uterine disturbance. When the processes of dentition (the appearance of the wisdom teeth) and utero-gestation meet in the same subject, the alveolar irritation should be kept under by leeches or scarification, on just the same principle as we should lance the gums during excito-motor disturbance in the first dentition, to prevent spinal erythismus and convulsions. In the caries so common in pregnancy, and which often attacks several teeth at the same time, extraction of the diseased teeth should be avoided as much as possible. In the first place, as the pain involves the nerves of many teeth, oftentimes the whole of one side of the jaw affected being neuralgic, the extraction of one or two of the offending teeth will not afford permanent relief. The uterine irritation remaining, the pain is generally transferred, after extraction, in all its intensity, to the nerves of the neighbouring teeth. In the second place, caries and toothach do not affect the nervous system so much as the sudden violence and the emotional disturbance of extraction. It is truly distressing to witness the almost continual misery in which some women pass through the epochs of utero-gestation and lactation from faulty teeth. This is particularly the case with the wealthier classes of patients; and the fact should urge very strongly upon parents the necessity of attention to the permanent dentition in young girls, for with this process the health of the future mother is most intimately connected.

III. The preventive measures relating to Vesical irritation are very simple. In the most formidable irritation of this kind, —the concurrence of calculus with pregnancy, and which is necessarily extremely rare,—nothing but palliative measures can be resorted to during gestation. The cure must be left to the unimpregnated state. Strangury and urinary deposits, attended with pain and irritation, must be treated carefully, but just as in the unimpregnated condition. Distention of the bladder during pregnancy should be avoided, and actual retention relieved regularly by the catheter. Attention to the state of the bladder is the more necessary in pregnant women, as the accidental distention of this viscus may, in the early months of pregnancy, cause retroversion of the uterus, and this, in turn, will produce permanent retention of the urine; the conditions of the bladder and the uterus thus uniting to occasion the danger of abortion.

IV. I now come to the preventive measures which relate to Ovarian irritation. Here our cautionary plans should be chiefly devoted to the catamenial or periodic dates. Patients suffering from severe ovarian irritation during pregnancy, should be treated in the periodic exacerbations much in the same way as we should treat dysmenorrhœal patients during the actual periods attended by pain and difficulty. Warm hip baths, not exceeding blood-heat; warm enemata within the same temperature; the application of a plaster of opium or belladonna over the sacrum; the application of a few leeches, and most especially the avoidance of coïtus during the periodic dates of pregnancy, should be directed. As regards the masked periods of utero-gestation, as they may be called, continence is as proper in all cases at these times, as it is during the actual flow of the catamenia. It is during the first half of pregnancy, or in those women who have suffered from dysmenorrhœa before impregnation, that moral and physical sedatives should be most strictly enjoined. I may here observe, that in dysmenorrhœal cases the times of conception are probably times of abortion, the impregnated ovum descending at once through the Fallopian tubes, uterus, and vagina, with an apparent return of the catamenial discharge, instead of tarrying for development in the uterus, so that women, under these circumstances, may never be conscious of having conceived, though they really have done so. There can be little question but that many supposed cases of sterility are of this kind; owing to increased excitability of the motor apparatus of conception, the generative act never goes beyond impregnated oviposition; abortion follows so closely upon conception, that neither the conception nor the abortion are perceived. Such cases, admitting, as they do, of almost certain remedy, are very different from cases of actual sterility. I have just said, that in ordinary instances of abortion excited by ovarian irritation, it is during the early months that precautionary measures are of most importance; but in those extraordinary cases in which abortion is caused by the adhesion of the placenta to the os uteri, it is in the latter periodic dates of pregnancy that the greatest danger is incurred, and that the greatest care should be given to its prevention. I mentioned to you in the last lecture, that, even when not the exciting cause, ovario-excitor action was still in many cases the determining cause of premature action of the uterus; so that in all cases of threatened abortion, and, indeed, of pregnancy, it behoves the medical attendant to treat the periodic dates with circumspection.

The questions of *rest* and *exercise* are of considerable importance in cases of expected abortion. Some authorities advise regular exercise; others, absolute repose from all exertion. There can be no doubt that walking exercise, carried to excess, excites all the pelvic organs, both the uterus itself, and those organs which are in reflex relation with it; and there can also be no doubt that exercise which in the unimpregnated state is simply moderate, comes to be excess in the gravid subject. On the other hand, rest and the habits of ease and indulgence, living on sofas and pillows, during pregnancy, favour the accumulation of irritability in the muscular system, including the uterus, and in this way often increases the chances of abortion. The safe rule seems to be, that moderate and regular exercise should be taken on ordinary occasions, but that repose should be ordered during the catamenial periods, when abortion is apprehended. But whenever the danger of abortion is very great, absolute and continued rest, physical and mental, is necessary. Since my last lecture, I have been called to a lady, the wife of a distinguished artist, in an abortion for the fourteenth time. Within five years she aborted ten times, always aborting or commencing the symptoms of abortion at the catamenial periods; she then bore a living child at the full time, by remaining in the recumbent position during the whole of pregnancy. Since I attended her in that labour she has gone on aborting, and I have no doubt will continue to do so as often as she becomes pregnant, unless she submit to perfect rest. In this case there is no disease whatever of the utero-vaginal passage, nothing, in fact, but an irritable condition of the ovario-uterine nerves.

V. The precautionary measures connected with Rectal irritation are very simple. They consist chiefly in the avoidance or removal of intestinal accumulations by laxatives and mild enemata; the removal of ascarides, when these worms are present; the palliative treatment of hæmorrhoids, all operations upon the lower bowel being avoided as much as possible during gestation; and lastly, the avoidance of drastic purgatives. It is, in fact, only necessary to recognise the rectum, not merely as a neighbour to the uterus, but as possessing an exictor surface and excitor nerves, prone to reflect irritation upon the uterus, through the spinal centre and utero-spinal nerves, and the prevention of abortion as a consequence of rectal irritation becomes easy and well understood. Rectal and vesical irritation, as causes of abortion, have always been recognised, but this recognition is more practical when we see the exact channels—the mechanism, in fact—by which irritation is conveyed from one organ to the other. With reference to abortion caused by any form of pelvic irritation, whether it be of the bladder, ovaria, rectum, or the uterus and vagina, it should be especially borne in mind, that every form of pelvic irritation is increased in intensity by the masked catamenial dates of gestation: both nervous and vascular excitement are present at these dates, so that they should always be an object of caution.

VI. The prevention of Vaginal irritation in women liable to abortion from habit, or in whom special symptoms lead us to expect this accident, involves as a preliminary the observance of the most rigid continence. In women who have aborted in previous pregnancies, sexual separation ought to be maintained during the whole of pregnancy; and in all irritable subjects, coïtus should be avoided during the ovarian periods of the gravid state. One useful point in the PERIODOSCOPE I have invented is, that it enables us to point out to our patients at a glance, these occasions of special risk. From not recognising the periodic tendency, women often expose themselves to unnecessary danger, particularly in the early months, when, from the increased aptitude for abortion, the depending position of the uterus in the pelvis, and the contraction of the vagina, the physical stimulus of coïtus is most exaggerated. It is no doubt for wise purposes, that in the lower animals, almost universally, the instinct of the gravid female leads her fiercely to reject the advances of the male. In cases where tumours in the vagina complicate pregnancy, it may become necessary to remove them, both to prevent abortion and to facilitate parturition. In all operations affecting the vagina, they should be so timed as to avoid the ovarian periods, and to fall upon what would be the hemicatamenial dates, when all irritation and disturbance can be better borne. I have already referred to the use of the plug or tampon sometimes necessary in threatened abortion with hæmorrhage, in cases where we still hope to save the ovum; the plug should not be so large as to stimulate the vaginal surface excessively, and it should be fairly introduced into the upper and roomy part of the passage, so as not to irritate the ostium vaginæ; at the same time there should be nothing like hard pressure on the os and cervix uteri. Whenever the presence of the tampon, carefully applied, permanently increases the periodic pains felt in threatened abortion, it should at once be withdrawn, unless we have resolved to abandon the ovum to its fate. The plug ought never to be left in the vagina more than twelve hours at a time, otherwise it becomes extremely fœtid and disagreeable, and probably injurious; it is better even to take it away and renew it oftener than this, and to dip it in a weak solution of the chloride of lime before its introduction.

VII. In threatened abortion from Uterine disturbance we may have to deal with morbid affections of the uterus, with disease of the placenta and membranes, or with disease of the uterus itself.

Any persistent irritation of the uterus, but particularly of the os and cervix, as the most excitor parts of the organ, may cause abortion; this is as natural as that irritation of the lungs should produce cough, or that irritation of the stomach should cause vomiting. In these cases we may have to deal with malignant disease of the uterus, syphilitic or gonorrhœal affections, or simple uterine disease, as inflammation, excoriation, or ulceration. In malignant disease complicated with pregnancy, our treatment can be little else than palliative; in syphilitic disorders, we must cautiously pursue that treatment which would be proper in the ungravid state; and in inflammatory diseases of the os and cervix, and their sequelæ, we must not shrink, because of the existence of pregnancy, from the careful use of the local applications necessary to effect a cure. Unless the uterine disorder be removed, there must be considerable danger of abortion. A patient may, it is true, pass through gestation safely, with considerable disease of the os uteri; even cancerous ulceration sometimes exists without inducing abortion; but there can be no doubt that the proper measures of treatment, most cautiously and judiciously pursued, though themselves sources of considerable uterine irritation, are less likely to cause abortion than is the disease itself, when severe, and allowed to proceed unchecked. The observations of MM. Boys de Loury and Costilhes, and the researches of Dr. Henry Bennet and Mr. Whitehead in this country, show that inflammation and ulceration of the os and cervix uteri, with mucous or purulent leucorrhœa, may co-exist with pregnancy, and that they may act as a cause of abortion; and it appears that they can be treated successfully during gestation, without necessarily disturbing this process. Whenever there is pelvic pain and leucorrhœal discharge in gravid patients who have aborted in previous pregnancies, the condition of the os and cervix uteri should be positively ascertained. The treatment found most successful in cases of inflammation, excoriation, or ulceration of the lower segment of the uterus, is sufficiently simple—namely, local abstraction of blood, and occasional cauterization of the diseased sites, every possible care being taken to prevent local and constitutional disturbance following upon the treatment. I ought to state, that while I do not doubt the frequent occurrence of inflammatory disorder and its consequences in the os and cervix uteri in pregnancy, still the organ has so recently become the subject of common visual examination, that I do not think the variations of colour, size, hardness, and the state of the circulation which may be consistent with moderate health in different classes of life, are as yet satisfactorily made out; and thus many cases may be set down to disease which are not truly and decidedly morbid: and in some cases of this kind, abortion has been positively excited by the treatment pursued to prevent it.

Retroversion of the uterus, though sometimes a cause of abortion, generally requires treatment and re-position, for more immediate symptoms than the premature contraction of the uterus upon its contents. In plethora of the pelvic circulation, and in congestion of the uterine vessels not amounting to inflammation, local depletion by leeches, either above the pubes, or applied to the os uteri directly, is advisable. I have often seen great comfort and relief from the sense of uterine heat and distention, produced by constantly wearing a pad, wetted with spirit lotion, over the pudendum.

In the prevention of abortion, morbid conditions of the Placenta require to be considered. The placenta is to the fœtus what the branchia are to the fish, the blood of the mother being the fluid medium in which the fœtus respires oxygen during intra-uterine life, a point which has been ably insisted upon by Professor Simpson. For this reason it appears to be, that the blood of the mother during pregnancy is more highly oxygenated than at other times, approaching to the state of inflammation, as may be seen by the buffy coat and the greater coagulability present in the blood drawn from pregnant women. The placenta has a tendency to become unfit for fœtal respiration towards the end of utero-gestation, when Nature is preparing for the change from branchial to pulmonary breathing. There is frequently observed on the surface of the mature placenta crystals of carbonate of lime, which must tend to interfere with its functions as a respiratory apparatus, and generally, I believe, to facilitate its separation from the uterus. This caducous preparation of the placenta, by the deposition of the salt of lime, is probably connected with the demand for ossific matter in the fœtus, but it must also remind you of the deposit of lime upon the egg of the bird, or of silica in the stems of ripe fruit, to facilitate its separation from the parent tree; or we may compare it to the deposit of earthy salts in the lungs in old age, as preparatory to the death of the individual. It is pretty certain that in some cases of abortion in the latter months, caused by the death of the fœtus, the death has depended on the low respiring power of the placenta, the placental development having progressed so rapidly as to render the organ prematurely deciduous. Under these circumstances, the child dies asphyxiated, unless born into the atmospheric air, just as the tadpole perishes when its branchial development has concluded, unless it can be removed from water to the air. In the opposite class of cases, we have sometimes to deal with retention and adhesion of the placenta, because it is not ripe for separation at the time of labour. Other morbid conditions of the placenta may tend to the death of the fœtus, and indirectly to abortion, such as inflammation and induration of the organ, tubercular deposit, or effusion of blood into its structure—placental apoplexy, as it might be called; but such morbid states are obscure in their diagnosis, and very much removed from definite treatment.

Dr. Power was, I believe, the first to enter fully upon these non-respiratory causes of abortion, and to propose means for aiding the respiration of the fœtus by purifying the maternal blood. He recommended the depuration of the blood of the mother, during pregnancy, by attention to diet, the respiration of pure air, and the careful regulation of all the secretions. In pregnancy, the lungs of the mother have to consume the carbon of two circulations; and in cases where, from the pressure of the abdomen upon the thorax, or contraction of the chest, the respiration is imperfectly performed, Dr. Power prescribed the inhalation of air containing an increased quantity of oxygen, or the use of medicines containing a large quantity of oxygen loosely combined, such as the nitric acid. More recently, Professor Simpson states that in cases where the fœtal respiration is imperfect, he has found the chlorate of potash useful on the same principle—that of arterializing the maternal blood. In cases where the death of the fœtus in utero, by asphyxia, has occurred in former pregnancies in the latter months, Professor Simpson further recommends the induction of premature labour before the death of the child. These facts should at least impress upon accoucheurs the importance of considering the state of the blood and the fœtal respiration in all cases of pregnancy. It is evident that the sanitary condition of the fœtus must always depend upon the purity of its respiring fluid in the bloodvessels of the mother.

In disease of the Fœtus, producing death, and abortion several times in succession, I fear little can be done beyond attending to the health of *both* parents. Some have recommended active treatment directed to the fœtus, founded upon the former post-mortem examinations of the fœtus; but a diagnosis in which, as at present, our knowledge of the state of the fœtus actually *in utero* depends on the examination of a previous fœtus, can hardly be depended on as a basis of treatment, notwithstanding the acknowledged tendency to repetition observed in intra-uterine disease. When the death of the fœtus has taken place, the natural result is an abortion forthwith. The respiratory changes going on in the placenta cease, and, as a consequence, the utero-placental circulation is very much diminished, or it is arrested altogether. The temperature of the fœtus falls, and the state of the fœtus and placenta excites premature contraction of the uterus, as mechanically as the rupture of the membranes or the insertion of a tent in the os uteri. In some comparatively rare cases the circulation still goes on in the uterine portion of the placenta, and the fœtus is retained to the full term. Or in cases of twins, there may be an abortion of a dead fœtus, and the retention of a living one to the full term of gestation. In all these cases, whether the irritation be in the uterine tissue itself, or conveyed to the uterus by a diseased or dead ovum, the mode in which the uterus is excited is reflex and spinal, and abortion can only be prevented by diminishing or removing the utero-spinal excitement.

The prevention of abortion depending on Habit, and occurring at a particular date of pregnancy, chiefly consists in taking all care to avoid the sources of uterine excitation until the time of danger has been passed. Dr. Griffin, of Limerick, treating the abortive habit as a periodicity, has proposed to administer large doses of quinine; and the suggestion may be useful in some cases. I strongly suspect that one frequent cause of periodic abortion arises out of immaturity of the uterus itself. In practice, we meet with many cases where, although menstruation has appeared, and marriage has been consummated, the uterus is very small indeed—not much, if at all larger than is natural in the young girl. Such subjects are open to many inconveniences. In cases of this kind, if conception takes place, the uterus is unfit for the full development of the gravid state, and when it has reached the largest size of which it is capable, abortion inevitably takes place. Sometimes we find, in these cases, that the capacity of the uterus for gestation will increase with every pregnancy, or with increasing years, until, after many abortions, the uterus becomes developed, and the full period is reached in safety. Other forms of abortion, sometimes set down to habit, may depend on those diseases of the uterus which are most troublesome at particular epochs of pregnancy—such, for instance, as retroversion, or ulceration of the os uteri.

In cases of Emotional abortion, we can do little in the way of prevention. The indication is of course to keep the mind, and particularly the uterine system, as tranquil as possible after all emotional shocks occurring during pregnancy. As it is generally some few days after the mental shock that the uterine disturbance begins, we have the time in which to do this afforded us; but the effects of emotion of a severe kind can never be altogether averted. Where there is already a tendency to abortion from other causes, emotional disturbances should be especially avoided. We may have the symptoms of abortion passing away, when some sudden ill news, an apprehension of fire, or any other acute disturbance, will produce an instant contraction of the uterus, and the expulsion of its contents. Abortion appears to be prevalent at particular times; but this epidemic is generally, I suspect, rather caused by mental emotion than by physical agencies. During the present time, when public catastrophes and apprehensions of evil are rife, and the throne and the cottage are alike agitated, I believe there is an unusual tendency to abortion. I am certain that I have seen several recent cases referrible to this cause.

It is worthy of remark, that in abortion the occurrence of hæmorrhage is far more frequent than in natural labour. Abortions are, indeed, rarely free from hæmorrhage, and a sanguineous discharge is the commonest symptom of a threatened premature expulsion of the ovum. When the circulation between the embryo and the mother is carried on by the decidua, as it is in the very early months, separation of any part of the ovum from the uterus must necessarily produce hæmorrhage; but as the placenta is gradually formed from the decidua and chorion, and the utero-fœtal circulation becomes circumscribed and localized in one particular part of the uterus, the chances of hæmorrhage are very much diminished, unless the placental portion of the ovum should be detached from the uterus. The decidua at first performs the function of a diffuse placenta, enveloping the whole embryo, so that separation at any point, in a commencing abortion, necessarily produces hæmorrhage. In this point of view, the hæmorrhage of early abortion is allied to the unavoidable hæmorrhage of placental presentation. When the placental portion of the membranes is attached high up in the uterus, and there is hæmorrhage, with discharge of the blood externally, the blood has burrowed its way by gradually separating the membranes from the uterus, so as to find a passage, after the manner of dissecting aneurism. Natural gestation, as distinguished from placenta prævia, admits of the expression of the following axioms respecting hæmorrhage:—The earlier the expulsion of the fœtus, the more certain is the occurrence of hæmorrhage, and the less the danger from loss of blood; but as pregnancy proceeds towards the natural termination, the chances of hæmorrhage diminish greatly, while its importance, when it does occur, increases in an equal degree. In abortion, the danger from hæmorrhage is before the expulsion of the ovum; in labour at the full term, it arises after delivery.

In abortion in the early months the uterine hæmorrhage itself is similar to the hæmorrhage occurring from other internal organs, and the means for arresting it are also much the same. We should aim at closing the mouths of the bleeding vessels, by diminishing the force and frequency of the circulation, by astringents, and by promoting coagulation by pressure, refrigerants, &c. The loss of blood itself so directly tends to diminish the circulation, that depletion is seldom necessary in abortion; the best astringents are the acetate of lead or pure tannin given internally; as refrigerants, the cold napkin applied externally, or ice introduced into the vagina, are useful; while the vaginal plug, or pressure over the pubis, are the best modes of producing coagulation mechanically. But all these remarks apply to the very early separations of the ovum from the uterus, when the uterus is not so developed as to be decidedly contractile. When pregnancy is more advanced, and the organ contracts, the mouths of the separated vessels are comparatively large, and new principles must be introduced into the treatment of the hæmorrhage. We can only arrest the flow of blood by exciting uterine contraction.

When we now use the tampon it is not to produce coagulation, but to excite contraction; if we apply cold, it ought to be with the same intention; internal astringents are of little or no service. This is a practical distinction, for if we apply cold to produce coagulation, it should be continuous; if for contraction, it should be intermittent. There is, of course, a time in the history of abortion in the early months, in which a combination of the two plans are advisable, according to the development of the uterus.

It is an important question,—When should the hope of saving the ovum be abandoned? Women have gone on to the full time after amputations, after local injuries in the neighbourhood of the uterus, and such extensive uterine hæmorrhage, that there could be no doubt a considerable separation of the ovum from the uterus must have taken place. There is in some women a remarkable tenacity of the product of conception, so that the effort to prevent abortion should be persevered in as long as possible. In expected abortion, one of the most sure indications of such an amount of disturbance in the uterine nervi-motor apparatus as will probably expel the child, is afforded by sudden relaxation of the bowels; before the regular contractions of the uterus set in, there is generally a diarrhœa, with some amount of tenesmus. We must judge of the proper times in which to adopt measures of expulsion and retention by the relation of the ovum to the os uteri, particularly its protrusion through the dilated month, and the amount of the previous hæmorrhage. If such changes in the ovum have occurred as to warrant our belief in its death, or if the hæmorrhage have endangered the mother, we should not hesitate about its prompt expulsion. In the later abortions, in the fifth or six months, auscultation affords a valuable aid to our diagnosis. If we can, in the earlier stage of the threatened abortion, hear the fœtal heart; and if, in the course of the hæmorrhage or separation of the ovum from the uterus, we distinguish the failure and cessation of the heart's action, we may conclude the Fœtus to be dead, and then think only of the delivery of the Mother.

In abortion, the chief danger to the mother is from loss of blood; but this is rarely so considerable as to occasion immediate risk, though nothing tends more surely to ruin the constitution than a succession of hæmorrhagic abortions. Other dangers—such as rupture of the uterus, and convulsions—are of still more rare occurrence. When it has been decided that the ovum cannot be saved, the uterus must be emptied as soon as possible. To effect this, the membranes must be ruptured—a measure which generally diminishes the hæmorrhage considerably, as the proportion of the liquor amnii to the size of the fœtus is greater in the earlier than in the later months. It is, however, more difficult to rupture the membranes in such abortions, owing to the undeveloped state of the os uteri, and the thickness of the membranes themselves. If the hæmorrhage continues, and the ovum cannot at once be removed, the sponge plug must be had recourse to, both with the intention of stopping the hæmorrhage and exciting the uterus to expulsive action; the plug should now be pressed upon, or even within the os uteri, if possible. If the os uteri be dilated, we can endeavour to separate the ovum from the uterus, and bring it down, care being taken not to break the friable mass it presents. The ergot of rye should be given to contract the uterus, and so arrest the hæmorrhage, and to aid in expelling the ovum in cases where it cannot be brought away by the fingers. When the uterus cannot be otherwise excited, a purgative enema will often bring on immediate expulsion. In many cases, a lingering abortion is terminated by vomiting, the expulsive effort being more powerful than the bearing-down excited by the ovum. In other cases, the occurrence of fainting ends the process, the syncope being accompanied by powerful contractions of the uterus. It often seems as though the undeveloped uterus was inadequate to expel its contents without the aid of some of the other expulsory processes, such as vomiting or defæcation. When the uterus has been emptied of its contents, the hæmorrhage almost invariably ceases; if it does not do so, we may be almost sure that there are either some parts of the membranes or coagula retained in the uterus and vagina, the removal of which, when they produce bleeding, is as necessary as the removal of the placenta in ordinary labour. It is well known that women do not suffer so much after loss of blood in abortions as in labour at the full term: this is because they have not been exposed to the wearying and irritating effects of full pregnancy, and because the abdominal pressure is not removed to the same extent; still, after abortions, the abdominal bandage should be applied.

To eradicate the abortive Diathesis, prolonged continence ought to be observed. A year's entire rest to the sexual system is not too much in severe cases, during which the catamenial periods should be most carefully attended to. Dysmenorrhœa should be relieved, if there happen, as there frequently will happen, to be a tendency to this disease. Any disease of the utero-vaginal passage should receive appropriate treatment. Everything which can possibly be devised should be resorted to, to give tone to the uterine nervi-motor system —such as the administration of iron in delicate subjects, the cold douche to the loins, and general cold bathing. In very obstinate cases I should be disposed to try the effects of a continued galvanic current through the spine and the sexual organs, or to prescribe small and continued doses of ergotine or strychnine as tonics of the utero-spinal axis. The general sedatives of the nervous system during pregnancy are, moderate exercise.spare and cool diet, small bleedings in plethoric or in sanguine habits, mental quiet, tepid or cold hip-baths, and, above all, a pure atmosphere. The nervous system in pregnant women resembles in its irritability the nervous system in infants and young children; ordinary narcotics are therefore stimulant rather than sedative, and as such ought not to be prescribed in ordinary cases during utero-gestation.

I may mention, in conclusion, that without a knowledge of Excito-Motor action, no large, comprehensive, or successful view can be taken of the pathology and therapeutics of Abortion.

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LECTURE XI.

PHYSIOLOGICAL STAGES OF LABOUR: I. THE PRELIMINARY STAGE OF LABOUR; PREPARATION FOR UTERINE ACTION.—II. THE STAGE OF DILATATION; PHYSIOLOGICAL AS DISTINCT FROM MECHANICAL DILATATION.—III. THE STAGE OF PROPULSION. DESCRIPTION OF A CONTRACTILE PAIN IN THIS STAGE.—IV. STAGE OF EXPULSION; DELIVERY.—V. SUPPLEMENTAL STAGE. REVIEW OF THE ORDER OF MOTOR ACTION. DECLINE OF ANÆSTHESIA IN OBSTETRIC PRACTICE. LABOUR PLACED AT THE BOUNDARY BETWEEN PHYSIOLOGY AND PATHOLOGY. THE PHYSICAL PAIN OF PARTURITION. OVARIAN, UTERINE, VAGINAL, PELVIC, PERINÆAL, AND LUMBAR VARIETIES OF LABOUR-PAIN. DISTINCTION BETWEEN PHYSICAL PAIN AND PHYSICAL SHOCK. AGGREGATION OF REFLEX ARCS IN THE MEDULLA OBLONGATA AND THE MEDULLA SPINALIS INFERIOR.

ADAPTING the terms to be used to the nature of the thing signified, as far as possible, I have endeavoured to make a physiological division of Labour into its several natural stages, each stage having its special physiological characteristics.

I shall describe—

I. The Preliminary stage, in which the preparations for actual labour are made.

II. The stage of Dilatation, in which the os uteri is dilated for the passage of the presenting part of the fœtus.

III. The stage of Propulsion, in which the fœtus is propelled through the os uteri and vagina.

IV. The stage of Expulsion, in which the fœtus is expelled through the external parts.

V. The Supplemental stage, in which the placenta and membranes are extruded, and in which the uterus returns to a state of permanent contraction, and at length to a state of rest.

I. *The Preliminary Stage.*

For two or three weeks before the date of parturition there is a subsidence of the abdominal tumour, the womb sinks into the pelvis; the waist, in consequence, becomes smaller, and the respiration and general mobility are less oppressed. There is a peculiarity of the female respiration which has been referred to by Dr. Hutchinson, the inventor of the spirometer, and which may be mentioned here. The upper part of the thorax is more mobile in the female than in the male. This is the cause of the graceful rising and falling of the breasts in female respiration, in the unimpregnated state; and it is obviously of importance in the respiration of pregnancy, when the inferior ribs are much impeded by the abdominal pressure. A few days before the accession of labour, the subsidence of the uterus is still more remarkable, and it now begins to contract in an equable and continuous manner, as though gathering itself up for the coming effort. This contraction of the uterus is moderate, but it is not at all paroxysmal, or attended by uterine pain.

In the preliminary stage of labour there is, then, the persistent contraction of the whole of the uterus, which I have just referred to. The uterus becomes firm and ovoid, and is more readily distinguishable from the rest of the abdominal contents than before. The abdominal tumour now becomes distinctly uterine. Owing to the persistent contraction of the uterus, the mother, missing the rolling movements of the uterus, frequently imagines the child to be dead. This quietude of the abdomen just before labour is an additional proof that the abdominal movements are uterine, and not fœtal. During this stillness the heart of the child may be heard beating as vigorously as ever, on applying the ear or the stethoscope to the abdomen of the mother.

Besides the persistent uterine contraction, there is usually an irritable state of the sphincters of the rectum and bladder. The bowels are generally opened two or three times, and there is a frequent desire to evacuate the bladder. The effect of these actions of the bladder and the intestines, is to free the pelvis and lower part of the abdomen from all unnecessary incumbrance, and so to give room to the parturient canal. Whenever the actions of the bowels and bladder do not occur naturally, the bladder should be relieved by the catheter, if necessary, and the lower bowel should be emptied either by an enema or a laxative.

In the preliminary stage, *the only excitor nerves involved are the ovarian.* To these nerves the uniform contraction of the uterus is due, and the uterine contraction is but an indication of that spinal excitement which is so soon to become evident, and under which, causes, which before called forth no special motor actions, are now to develop all the different actions of parturition. The ovarian excitement is the *first* in the order of events; the spinal excitability, the action of *the uterine motor nerves*, and the impulsion of the presenting part of the child against the os uteri, follow it. The latter, in its turn, gradually excites the contraction and dilatation of the next stage of the process.

II. *The Stage of Dilatation.*

The first signs of actual parturition affect sensation, secretion, and motor action. There is the lumbar pain; the flow of mucus tinged with blood from the os uteri and vagina; and lastly, there are the motor actions of the uterus and the neighbouring organs. These are the preparations for the dilatation of the os uteri and vagina. In actual labour, the lumbar pain gradually becomes intermittent, instead of continuous, and each distinct pain is accompanied by contraction of the fundus and body of the uterus, and by distinct dilatation of the os uteri. Obstetricians differ much respecting the nature of these contractions and dilatations, and elaborate descriptions are often given of longitudinal, and oblique, and circular fibres, and of one set of fibres overcoming the other, which really have had no existence, anatomically or physiologically. But chiefly, the dilatation of the os uteri has been considered a mere mechanical distention.

I contend for a positive dilatation of the os uteri, over and above the mechanical dilatation of this structure by the pressure of the amniotic bag, and the tension exerted on the opening mouth of the uterus by the contractions of the rest of the organ. When discussing the different motor actions of the uterus, I have adduced the proofs which I think show that the os uteri is an imperfect sphincter, and that, like other sphincteric muscles, it is subject to reflex dilatation and reflex contraction. There is this harmony and adaptation existing between the actions of the different parts of the uterus,—that whenever the fundus uteri contracts, the os uteri has a positive tendency to dilate. If it were not so,—if the os uteri contracted during the first stage of labour, as forcibly as it does in some cases of encysted placenta, or of inversio uteri, no power in the muscular fibres of the body and fundus could tear it open, much less any fluid pressure brought to bear against it by the action of the uterus upon the liquor amnii. Not only the os uteri, but the vagina, whose sub-mucous fibrous sheath is continuous and identical with the substance of the uterus itself, has a tendency to dilate during this stage of labour. In many cases the os uteri dilates before any considerable pressure is brought to bear upon it, and this is still more distinctly the case with the vagina. This physiological, as distinct from a mechanical dilatation, appears to be a very simple matter, but it is, nevertheless, one of considerable controversy among obstetricians.

Dr. Rigby, for instance, observes that "the os uteri does not dilate merely by the mechanical stretching which the pressure of the membranes and presenting part exert upon it; it dilates in consequence of its circular fibres being no longer able to maintain that state of contraction which they had preserved during pregnancy; they are overpowered by the longitudinal fibres of the uterus, which, by their contractions, pull open the os uteri in every direction." There is here no recognition of the positive dilatation for which I am contending. Everything is referred to the distention of the os uteri by the membranes, and its mechanical extension by the mechanical force exerted against the os uteri by the fundus and body of the uterus. The opinion held by Sir Charles Bell was very similar to this. Another obstetrician, Dr. Ramsbotham, maintains the independent dilatation of the os uteri, but does not give the physiology of this point. Dr. Ramsbotham remarks, "Some physiologists would teach us to believe that dilatation in labour is entirely a mechanical act; that as the uterus contracts, it propels the head first through the os uteri, by dilating it mechanically, then through the vagina, and, lastly, through the external parts, solely by the same forcible distention. It is evident, from the structure of the organs, that a mechanical dilatation, to such a great extent, never could take place, unless a corresponding disposition to relax were given them at the same time; therefore we must consider the dilatation of the passages not entirely dependent on mechanical distention, but that it is, in a great measure, to be referred to that institute of nature which induces them to become relaxed and softened when the uterus is about to commence contraction." The "disposition to relax" is nothing else than an active, positive dilatation; the "institute of nature" the reflex function. Viewed by its light, there is no difficulty whatever in comprehending the dilatile action of the os uteri. The dilatation of the os uteri in parturition, while the uterus is contracting, is analogous to the dilatation of the cardia with contraction of the œsophagus, the dilatation of the sphincter ani with contraction of the rectum, or the dilatation of the cervix vesica with contraction of the bladder. The only difference is one of time; the sphincteric orifice of the uterus is much slower in its actions than the sphincteric action of the orifices of the other organs of expulsion and ingestion. I might refer to many other authors besides those I have quoted, to show you the great differences of opinion which have been and are now held respecting this point.

The direction in which the motor force of the uterus is exerted is downwards and backwards, in the direction of the axis of the uterus, and in that of the axis of the inlet of the pelvis. When the full dilatation of the os uteri has been reached, the medulla oblongata is for the first time involved in the process, and sickness generally occurs. The dilatation of the os uteri tends, by reflex action, to dilate the cardia, and it often goes on to produce actual vomiting. When the stomach is emptied of its contents it increases the freedom of the respiratory movements, and promotes the dilatation of the parturient canal. Sickness is sometimes present during the whole of this stage, but, if not, it frequently appears at this juncture.

It is not a little remarkable, that in the early part of dilatation the excitor nerves affected by the pressure of the membranes and fœtal head should be in relation with the lower medulla and the uterus, only, while those which come to be excited at the time of full dilatation of the os uteri should affect the medulla oblongata, and the muscles engaged in the act of vomiting, including a considerable number of the muscles of respiration. Another singular affection of the muscular system now occurs. A very distinct rigor, or shivering of the muscles, is often observed at the time when the os uteri is completely dilated. This rigor is very similar to the shuddering produced by the dilatation of other sphincteric muscles. Many persons experience it when the first morsel of food at a meal is passing the cardia, when the urine first passes in micturition, or when a catheter is passed, or when the sphincter ani first dilates. These rigors, accompanying the full dilatation of the os uteri, are sometimes so severe and continued as to excite alarm, lest they should pass into general convulsions; and this is, in fact, one of the modes in which the invasion of the puerperal convulsion occurs. The sequence of events must be kept clearly in view; it is the ovarian irritation which excites the equable contraction of the uterus; then follow the impression of the ovum upon the os uteri—the orificial irritation which leads to the dilatation of the os; but the orificial irritation is undoubtedly secondary to the irritation of the ovaria. It is at the time of the full dilatation of the os uteri that the bladder and rectum have the greatest tendency to act. The sphincteric orifices of the uterus, bladder, rectum, and stomach, are frequently all associated in action at this time. This physiological connexion between the cardia and the os uteri is the basis of the treatment of rigidity of the os uteri by tartar-emetic or ipecacuan. The reflex action of dilatation between the os uteri and the sphincter ani may also be resorted to with benefit in rigidity of the uterine mouth; a warm enema will often do wonders.

The last act of the stage of dilatation is the rupture of the membranes, and the entire or partial discharge of the liquor amnii. The membranes having acted as an efficient dilator of the os uteri, as far as it dilates by mechanical distention, suddenly give way, and the uterus becomes smaller in compass, contracting more closely and powerfully upon the fœtus. As long as the membranes are unbroken, the circulation in the uterus is not materially interfered with, and the contractions are not so powerful as they afterwards become, on account of the disadvantages under which the uterine fibres act. When the quantity of liquor amnii is excessive, the distention of the uterus prevents any efficient muscular action, and is the cause of one variety of tardy labour. But so soon as the waters are discharged or diminished, the uterus contracts closely upon the fœtus, and prepares itself for the stage of propulsion, which we shall have next to consider. The circulation in the uterus, and consequently the changes going on in the placenta, are then considerably interfered with; so that the stage of propulsion is of much greater moment to the life of the fœtus than the stage of dilatation, which is now brought to a conclusion.

In the dilatile stage of labour, *the ovarian nerves, and the nerves of the os and cervix uteri*, are acting as spinal excitors; and the motor actions excited are almost entirely limited to the uterus: *the only motor nerves involved are the uterine nerves.* Until the termination of this stage, none of the other spinal functions are disturbed, except those of the rectum and bladder. The uterus is contracting and dilating alone. The portion of the spinal centre involved is the lower medulla; the medulla oblongata, or the functions over which it presides, not being at all affected.

III. *The Stage of Propulsion.*

At the time when this stage of labour commences,—namely, the point at which the liquor amnii is discharged, and the os uteri becomes fully dilated,—the motor force of parturition is applied in quite a new direction. The direction in which the fœtus has now to pass is in that of the axis of the outlet of the pelvis, which is outwards and downwards. It is at this point that the respiratory muscles come into play, particularly the abdominal muscles, and thus the new direction is provided for. Before the dilatation of the os uteri, we had to consider the fœtus as an ovoid mass, and the axis of this ovoid was the same as the axis of the uterus, and as the axis of the inlet of the pelvis. After the dilatation, we may speak of two axes of the fœtus—one the axis of the head, in its long or occipito-mental diameter, the other the axis of the body of the fœtus. Now this axis of the head, in a natural presentation, is nearly the same as the axis of the outlet of the pelvis, through which it has to traverse; and the fœtal body being flexible, readily passes, as it descends, from the direction of the superior to that of the inferior pelvic axis. All these correspondences cannot fail to strike your attention, but they are only a few of those which accompany this stage of parturition.

I have already mentioned to you the advantage given to the uterus by the rupture of the membranes. The same circumstance is equally favourable to the action of the abdominal muscles. A further adaptation, therefore, becomes visible in the precise time at which the liquor amnii is discharged. When the bulk of the uterus is increased by the liquor amnii in addition to the fœtus, the abdominal muscles are so distended that they could only act with difficulty. But after the diminution of the size of the uterus by the discharge of the waters, the abdominal muscles are more free to act, and it is now that they are called upon to aid in the expiratory actions which propel the head of the child through the vagina. When voluntary movements of expiration are unadvisedly made during the stage of dilatation, they are always awkward and fatiguing to the patient; but during the stage of propulsion, the contractions of the abdominal muscles are so powerful as to be no inconsiderable stimulus to the uterus itself. I mean that, besides their direct expulsive power, the pressure they exert upon the uterus excites this organ to more powerful action. Thus, in this stage of labour, when the uterine contractions flag, they can sometimes be renewed by voluntary contractions of the expiratory muscles.

But there is a cause for the intervention of the respiratory system, as well as the sign of its utility. I mentioned that, in the stage of dilatation, the ovarian and uterine nerves were the excitor nerves of the motor actions which then occurred. As soon, however, as the fœtal head, protruding through the os uteri, begins to press upon the vaginal surface, a new set of excitor nerves become implicated. These nerves are the excitors of the expiratory actions of parturition. As long as the internal surface of the uterus alone is irritated, whether by the fœtus, a polypus, or other bodies, the uterus contracts by itself; but as soon as the vagina is impinged upon, the expiratory force is brought to bear. Another point worthy of observation is, that the excitor nerves of the uterus, except at the extreme dilatation of the os uteri, when the stomach was disturbed, were in connexion with the lower portion of the true spinal marrow only; but the vaginal excitor nerves are in relation both with the lower medulla and the medulla oblongata. By the lower medulla, and the excitor and motor nerves in relation with it, reflex actions of the uterus are produced by excitation of these nerves; while all the reflex actions of the respiratory system depend upon the medulla oblongata. If the spinal marrow were divided in the middle, there could be no respiratory action in parturition. I have already referred to cases of this kind in actual practice. Voluntary efforts, and the forcible efforts of emotion, are often mixed up with the pains; but the essential acts of this stage of labour are truly reflex in their nature. The expiratory actions occur during the insensibility of puerperal convulsions, when emotion and volition are both suspended. If they were not reflex and physical in their nature, the exhaustion following a strong labour would be far greater than it is. We see even weakly women making powerful efforts, but perfectly refreshed between the pains, and after several hours of severe labour, easy and composed, complaining of nothing beyond the mere soreness of the muscles consequent upon their energetic contractions.

But I proceed to describe, *seriatim*, the motor phenomena of the contractile part of a pain in this stage. At the coming on of each pain, the patient takes a deep inspiration, as a preliminary. Expiration then takes place slowly and forcibly, in a succession of gasps, and when the air in the thorax is diminished, it is suddenly renewed by hasty inspirations. Each pain consists, as far as the respiratory muscles are concerned, of several sudden and deep inspirations, followed by prolonged and laborious expiratory efforts, with the glottis

MANCHESTER MEDICAL

partially or entirely closed. At the acme of a pain in this stage of labour, the glottis and cardia are entirely closed, the glottis only opening partially at intervals, and the abdominal and all the other ordinary and extraordinary muscles of expiration being forcibly contracted. The diaphragm remains inert, as in vomiting, with the actions of which, except that the cardia is closed instead of opened, the actions of the expiratory muscles in labour may be compared. All obstetric writers have taught that the diaphragm contracts in this stage; but if it be considered for a moment, that the diaphragm is a muscle of inspiration, while the actions of parturition are expiratory, the fallacy of such a view of the action of the diaphragm must at once appear. Of the contraction of the abdominal muscles during this stage of labour there can be no doubt; and the actions of the diaphragm and abdominal muscles are antagonistic. It is true that the floor of the diaphragm, instead of being arched, as in an ordinary state of relaxation, remains plane, during the efforts at inspiration, with the glottis closed; but this is from the mechanical distention of the chest by the contained air, not from an active contraction of the muscle itself. Besides these actions, which are all involuntary and reflex, the patient voluntarily aids in fixing the thorax, by holding some fixed body with her hands, or planting her feet firmly. More than this, she increases all the expiratory actions by strong efforts of the will, and by that emotion of labour which impels her to brave every suffering to effect the birth of the child. At length, when the pain can no longer be borne, the short gasp or groan is exchanged for a cry which dilates the glottis, and the pain and contractions subside. The cry is a motor action, excited by the emotion of pain, and instantly relieves the uterus of all extra-uterine pressure. Thus, the glottis may be compared to a safety-valve, which is thrown open by emotion whenever the pressure becomes more than can be borne with safety. By the influence of volition we have this valve entirely under our control, to open or close it, as may be necessary. When the expiratory actions are weak, we can enjoin the patient to hold her breath, and when they are too intense or too long continued, we can encourage her to cry out, which is of course equivalent to dilating the glottis, and expiring the contents of the thorax. During all this time the uterus contracts powerfully.

The excitor nerves involved in the stage of propulsion are, *the ovarian, the uterine, and the vaginal nerves;* these are in relation both with the medulla oblongata and the medulla spinalis inferior. The motor nerves excited to action are, *the uterine nerves and the whole of the motor nerves of the class of expiratory muscles.*

IV. *Stage of Expulsion.*

This stage of labour is the shortest of the whole progress, but it is the most important and decisive of all. It often compresses into a few moments as much suffering and as much concentrated action of mind and body, as would go to an age of ordinary life.

All the actions of the propulsive stage continue with unabated vigour. The uterus contracts with full power, the respiratory muscles act with immense force. The intervals between the pains diminish as the close of the struggle approaches; and there is often a perfect storm of uterine contractions, without sufficient intermission to enable us to say distinctly where one pain ends and its successor begins. When the fœtal head is actually passing the ostium vaginæ, a new set of actions make their appearance. The perinæum, after being distended to the utmost, is now retracted over the head by the action of the levatores ani; the sphincter ani and sphincter vesicæ dilate suddenly, the vagina contracts upon the advancing mass, and the head glides rapidly into the world. The dilatation of the two sphincters, between which the vagina is placed, compensates admirably for the absence of a perfect sphincteric muscle at the outlet of the parturient canal. The effect of this double dilatation s, that at the precise moment when there is the most imminent danger of laceration, there is a sudden and considerable removal of tension from the parts endangered. The dilataion of the sphincters is partly dependent on the sensation and emotion of severe pain, and partly on the reflex dilatation peculiar to the sphincteric muscles. This view of the subject gives interest and importance to an action which has never een looked upon but as a very disagreeable *contretemps*. Physiology here, as in many other instances, transmutes the meanest actions of the economy, rendering them noble by virtue of their uses! At the same moment that the orifices of the rectum and bladder are thrown widely open, there is generally a dilatation of the glottis. Even from women who restrain the expression of their emotions during the rest of labour, a cry of pain escapes at this juncture; this cry is necessarily accompanied by an open state of the glottis. The opening of the glottis is not at all accidental or voluntary, but is as regular and involuntary as its closure during the propulsive pains. Its effect is suddenly to take away the expiratory pressure from the expulsive action. Without this combined action of the glottis, and the sphincters of the rectum and bladder, for the defence of the ostium vaginæ, recto-vaginal laceration must be a very common accident of parturition. Such would inevitably be the frequent result of closure of the abdominal and thoracic cavities at all points, except that of the point of exit for the fœtus, in the final throes of labour.

The excitor nerves involved in the stage of expulsion are, *the ovarian nerves, the uterine nerves, the vaginal nerves, and the nerves of the ostium vaginæ;* the upper and lower divisions of the spinal centre are implicated, as in the stage of propulsion. The motor nerves excited to action are, *the uterine, vaginal, and respiratory nerves, and the nerves of the sphincter ani and sphincter vesicæ.*

Altogether, it must be conceded that parturition is the most voluminous of all the motor functions. The human uterus contracts sometimes sufficiently to render the hand of a strong man powerless. In order to illustrate the wonderful muscular power of the heart, the circulation in the whale or the elephant is often referred to by physiologists; but enormous as is the power of the heart in these animals, the parturient actions by which they bring forth their enormous young give us the most colossal idea we can entertain of any single muscular action. In the human subject, too, there is a certain grandeur in the combined efforts brought into play in parturition. In women even of moderate strength and stature, every voluntary muscle of the body is in strong action; the excito-motor force is in a state of the greatest activity; the uterus, unseen, and without any participation with the will, is making its immense contractions; and emotion imparts strength to both voluntary and reflex actions. At this juncture it is that the accumulated efforts of a natural labour pass most readily into the convulsions of the puerperal state, the most tragic spasm we can ever witness, often more terrible than even tetanus or hydrophobia itself.

A temporary calm follows the energetic actions which issued in the delivery of the mother. After the excessive action in which nerve and muscle seemed strained to the utmost pitch, there comes a sudden and profound repose; there is perfect freedom from pain; every fibre is relaxed; only the uterus now contracts of all the muscles which were so lately struggling. Like some ship which turns from a tempestuous sea into a safe and quiet harbour, the new mother passes from the storm of childbirth into the tranquil haven of of maternity. In the pathetic words of Scripture, "A woman when she is in travail hath sorrow, because her hour is come: but as soon as she is delivered of the child, she remembereth no more the anguish, for joy that a man is born into the World."

V. *Supplemental Stage.*

When the body of the child is born by the motor actions I have been describing, the contracting uterus follows closely upon it in its descent, and the action of the uterus, excited at this time from the immense irritation of the vagina by the advancing fœtus, is frequently sufficient to throw off the placenta, and lodge it in the upper part of the vagina. When the placenta is not separated in this way by the last expulsive pain, it remains quietly in the uterus until the appearance of the first after-pain. During this interval the uterus contracts with tolerable firmness, under the influence of the excitement of the act of expulsion. If the placenta has been expelled into the vagina, its presence in this situation excites, after awhile, bearing-down pains and contraction of the vagina, similar to those of propulsion and expulsion, only far more inconsiderable, generally requiring slight traction of the cord to complete its removal. When the placenta remains in utero, it becomes separated from the uterine surface by the contractions of the uterus, and by the arrest of the circulation in the umbilical cord. It is then removed by a miniature copy of labour itself; there is a dilatation of the os uteri, and there are the propulsive and expulsive actions of the uterus and the expiratory muscles, on a small scale.

After the expulsion of the fœtus, the first act of the uterus is to contract, so as to prevent the occurrence of hæmorrhage. This contraction is induced, in the first instance, by the concluding irritation of the vagina and perinæum, on the exit of the fœtus. It is subsequently ensured by a succession of stimuli. Of these, some are uterine, others are extra-uterine. The bulk of the placenta and membranes irritate, in the first place, the now contracted uterine surface. When placental separation has occurred, the abraded surface of the uterus is intensely excitor; and as the placental mass passes through the vaginal passage and ostium vaginæ, excitation, which insures full uterine contraction, is supplied. It is a peculiarity of the utero-vaginal canal, that at the termination of labour, all the surfaces are more instantly excitor, and the answering motor contractions become more rapid and more easily provoked. During severe labour, irritation of the os uteri, or of the vaginæ, will often increase the pains only in a moderate degree; but now, the introduction of the hand into the vagina, and irritation of the os uteri, will excite instant and forcible contraction of the uterus. The extra-uterine excitors of uterine action now come into play in a remarkable manner. During the whole of labour, the uterus has been acting upon the mammæ, causing them to become irritable and tumid. In return, as soon as the child is put to the breast, the slight irritation of the mammary excitor nerves excites distinct contractions of the uterus. This reflex relation *from* the breast *to* the uterus continues for several days after parturition, until, in fact, the uterus has returned to the natural state. As soon as the secretion of milk is established, there is, at every afflux of blood to the breasts causing the sensation termed by women " the draught," an answering contraction of the uterus. A reflex relation between the stomach and the uterus is also now set up. Every time the patient drinks her gruel, or takes her tea, sharp contractions of the uterus, after-pains, in fact, are excited. Emotion is another aid to the permanent contraction of the uterus. Any emotion of the mind will generally produce an after-pain, but the maternal emotion especially. The emotion produced in the mind of the mother by suckling her infant induces contraction. A day or two after labour, merely presenting the infant to the mother, without its actual application to the breasts, will excite the sensation of the draught in the mammæ, accompanied by a sudden secretion of milk, and also by contraction of the uterus. Besides these various sources of excitation to the uterus, the ovarian stimulus continues, and it is to this latter, I believe, that the lochial secretion is due. Thus the close of labour, the return of the uterine system to the quiet of the unimpregnated condition, is as plentifully provided for as the commencement, or any of the various stages of the process. For some days after labour the contraction of the uterus is of an active sphincteric kind, but its vascular and other tissues rapidly diminish in size, and it soon becomes a non-motor organ, as it was before the time of conception.

The excitor nerves involved in the supplemental stage are *the ovarian, uterine, and vaginal, together with the mammary and gastric nerves;* the spinal centre and the motor nerves are affected in the same manner as in the stages of dilatation, propulsion, and expulsion, only in a minor degree.

We can now review the order of the nervi-motor actions of labour, the series of excitor surfaces involved one after the other, and the regular succession of stimulus and contraction in the different stages of the process. First in the order of events, there is the excitation of the ovarian nerves, followed by the equable and continuous contractions of the uterus. Then there is the pressure exerted by the fœtal head, as yet defended by the liquor amnii, upon the os uteri, and the consequent excitement of the orificial nerves, with the answering and intermittent contractions of the uterus. In the next place, the vaginal excitor nerves are irritated by the pressure of the now advancing and undefended head, or presenting part of the fœtus, an irritation which calls forth the respiratory actions of labour in addition to the uterine contractions. Then we have the excitation of the nerves of the ostium, vaginæ, and the remarkable modifications of motor action thus produced. After the expulsion of the fœtus, the placenta remains to supply an intra-uterine stimuli, sufficient to affect the now exalted excitability of the uterine nerves, and thus to cause its expulsion. When the placenta has been expelled, the excitation of the uterine surface, from which the placenta has been separated, the excitation of the mammary nerves by suckling, and by the secretion of milk, and the excitation of the pneumogastric, now in excito-motor relation with the uterus every time food or drink are taken, are, with the aid of emotion, and the continuing ovarian irritation which has been present during the whole of labour, perfectly sufficient in normal cases to prevent hæmorrhage, and gradually to effect the return of the uterus to the contracted and comparatively small size of the unimpregnated woman who has borne children.

A year ago, and all women were promised safe and perfect exemption from the pains of natural labour. Now, however, the anæsthetic Elixir proves to be but a cup of Circe, instead of the true birth-help. At the present time, when the febrile excitement of the medical mind upon this subject is rapidly passing away under the influence of the numerous fatal cases which have occurred from the use of anæsthetic agents, there seems a more than ordinary necessity for dwelling upon the manifold wisdom with which the act of parturition is surrounded. Woman will certainly derive truer comfort, and a greater measure of safety and freedom from unnecessary suffering, from physiology, than from a wild therapeutics, which, in her hour of trial, only offers a choice betwixt poison and pain.

Parturition is undoubtedly a physiological process, and one exhibiting the most liberal provisions for its safe and regular performance. The Final Cause argument is visibly written upon every stage of delivery. There is quite enough of design in human parturition to furnish a new Paley. Yet the function stands, as it were, at the boundary between physiology and pathology, being attended by more pain, and being liable to a greater number of accidents, than any other physiological act of the economy. Labour is a drama, painful to the individual, and exciting painful interest in those around her: in the great majority of cases it ends happily, and all the parties come forward with smiling faces at the close: but at any act or incident the curtain *may* fall upon a tragedy. A profound acquaintance with its physiology is the best guarantee of its safe conduct, and of the relief of child-birth accidents. Obstetric practice affords one of the most striking examples in medicine of the near relationship between physiology, living pathology, and true therapeutics.

I know of no good account of the Pain of labour—by this, I mean, the physical pain as distinct from the uterine contraction. Grave discussions have been raised as to whether pain in travail is natural to the sex. I prefer describing these pains as they actually exist, to any abstruse disquisition of this kind, particularly as it is now felt by most prudent persons that there is no safe or royal road of escape from them. They may be diminished, though not destroyed, and to diminish them they must be understood. The first physical pain of labour is, I believe, rather oophoralgic than hysteralgic; it is more ovarian than uterine, and is very similar to the pain of a dysmenorrhœal attack. This kind of pain continues, though modified by other varieties of pain, throughout parturition. Patients themselves refer it almost entirely to the back and loins. By and by, true uterine pain commences, and the pain now encircles the lower part of the abdomen. The uterine pain is partly caused by the dilatation of the os uteri, and partly by the powerful contractions of the uterus upon itself. All violent and continued muscular contractions produce an acute or aching pain of the muscles engaged. The purest type of the contractile uterine pain is seen in the after-pains, when there is nothing to be expelled, the uterus contracting simply upon itself, and often exciting intense pain. When the full dilatation of the os uteri has been reached, and the fœtal head enters the vagina, the pain of vaginal distention takes the place of the dilatile pain of the os uteri. This pain not only involves the mucous and fibrous sheaths of the vagina, but the soft parts of the pelvis and the pelvic bones, particularly the symphysis pubis and the sacro-iliac synchondrosis. But the most acute pain of all occurs when the fœtal head engages in the ostium vagina, this part of the parturient canal being more plentifully supplied with nerves than any other part of the utero-vaginal canal. With the exception of the dilatile pain at the os uteri, which, though often intense, ceases when full dilatation sets in, all the varieties of pain I have been enumerating accumulate from the commencement to the termination of labour. They even increase in intensity as the course of labour proceeds, and undoubtedly, the more lingering a labour happens to be, the more painful will the latter pains of every description become, the sensibility of every part of the canal becoming exalted by prolonged excitement.

Besides the pains of the ovaria, uterus, vagina, and perinæum and the pelvic pain, there is another important kind of pain present in almost all labours. This is the comparatively superficial pain of the lumbar region. Pressure with the hands of the nurse will generally relieve this pain, but sometimes the surface becomes so tender that no pressure can be endured, and the patient refers her chief suffering to this region. This painful state of the posterior lumbar and sacral nerves of sensation, during parturition, is of a radiate or reflex kind, evidently depending upon the condition of the parturient passage. Cases occur in which it is not the back which is the seat of this kind of pain, but each returning contraction of the uterus excites severe pain in the thighs, legs, or feet; or I have seen it confined to one foot. I am not now speaking of cramp or painful muscular contraction, but of simple extra-uterine pain, occurring in the superficial sentient nerves.

It is a common observation, that the pains of labour differ very much in kind and intensity at different stages of the process. The pain felt during the dilatation of the os uteri differs very much from the pain felt during the propulsion of the child through the vagina, the one being called "grinding," the other, "bearing." These words refer in part to the kind of pain, in part to the kind of contraction, and they are expressive in both senses. Not only is there this striking difference between dilatile and propulsive pain, but every step of the parturient function has its special kind of pain.

You have only to consider the nervous endowments of the different organs and regions concerned in labour to understand this. There is, first, the ovarian pain preceding and ushering in labour, in which the purely ganglionic nerves are concerned, and there is the ultimate pain, as the fœtus passes the perinæum; this region being, as you are aware, supplied largely by purely cerebral sentient nerves. These parts of diverse innervation are as strikingly dissimilar in their sensations, but in lesser degrees; the ovarian differs from the uterine, the uterine from the pelvic, the pelvic from the vaginal, and the vaginal from the perinæal pains; to say nothing of the superficial lumbar pain, which is peculiar in itself.

There is something very remarkable in the differing fortitude of women in different stages of their sufferings. The purely uterine pain is extremely depressing. In the stage of dilatation, or during severe after-pains, when the uterus is acting alone, women of the highest courage falter, and give way to the most despairing ideas; but in the propulsive and expulsive stages, when the whole muscular system is in a state of the greatest tension, the passionate energy of the mind is so far in unison with the bodily exertions, that women will often voluntarily increase their sufferings to the extremest pitch, before giving way to that laryngeal cry which generally leads to the remission of the contractions and the subsidence of the physical pain.

The physical pain of labour, as distinct from the muscular contractions, is undoubtedly depressing in its effects; but still it is unlike other and purely pathological pain, inasmuch as it may be very distressing, and yet disappear entirely during the intervals of the pains, so that in a painful labour the patient may sleep or remain quite cheerful between the pains, and at the close of delivery may not feel an amount of exhaustion proportionate to the intensity of her suffering. After operations, or in very painful diseases, death may be caused apparently by the simple effects of excessive pain. But in death occurring after delivery, or during the course of prolonged parturition, the merely physical pain of labour must never be considered alone; it must be viewed in connexion with the physical *shock* of labour as distinct from physical *pain*. Pain affects the cerebrum; shock affects the spinal centre, which does not feel pain. Every severe throe of a protracted labour is a distinct blow to the brain, in so far as it is painful; and it is also a distinct blow upon the spinal centre, as much so as though this organ had actually been struck. The brain is more resilient, as it were, under shock than the spinal centre; and when parturient women die of sinking, it is from the effects of the successive shocks of the pains of labour upon the medulla spinalis rather than upon the cerebrum. This view of the subject leads to important modifications of the treatment of sinking, and the effects of shock in parturition.

There is an unpublished experiment, of great interest, by Dr. Marshall Hall, not performed with reference to parturition but during his electrogenic researches, which may be brought to bear upon this point. He took two frogs, divided the spinal marrow in both, and then immersed them in a solution of strychnine till they became tetanic. When allowed to become perfectly still, they would remain without spasm if carefully defended against all external excitation. When in this state, one frog was kept in a state of perfect repose; the other was irritated from time to time, so as to produce strong tetanic action. Of these two frogs, the first would recover perfectly in a few days, the second would die very quickly. There was here no sensation of pain, because the spinal marrow was divided; the exhaustion was therefore purely of a spinal or physical kind. Dr. Marshall Hall himself applies this experiment to the treatment of tetanus; but it has also an application to the physical pains of parturition. When women die from prolonged labour, death occurs, not merely from exhaustion by physical suffering, but from exhaustion caused by the strong muscular contraction of the uterus and its associated organs. The discharge of the vis nervosa and the vis insita in the muscular contractions of each pain has a depressing effect quite distinct from, and independent of, the mere painfulness of each uterine action. Each of the great contractile efforts of labour has an exhausting effect; but when more severe, or continued longer than usual, every returning pain is a distinct *shock*. A woman insensible to pain may still sink, and perish from the spinal shock of labour.

One effect of this shock, as it ordinarily occurs in parturition, is in a degree to paralyze the rectum and bladder. Inability to empty the bladder is very common for some days after a severe labour; and in rare cases, the atony of the vesical nerves becomes chronic. This state of the bladder is commonly referred to physical injury of the cervix vesicæ, rather than to any nervous shock, but though local injuries do occasionally occur, causing retention or incontinence of urine, I am convinced that the inactivity of the bladder after parturition is, in the majority of cases, the result of nervous shock. The rectum is similarly and even more constantly affected after labour, and from the same cause. Constipation is so constant, that it is almost a matter of routine to prescribe a laxative two or three days after delivery. I am given to understand that homœopaths leave the bowels to chance, or give globules of arnica,—much the same thing, according to our belief,—and the result is, that the bowels are often not moved until eight or ten days after delivery—a practice which must necessarily predispose the subjects of it to puerperal fever or convulsive attacks. It is as proper to relieve the bowels as soon after labour as it can be done without disturbing the uterus, as it is to relieve the bladder when retention occurs. Not only the shock of parturition, but other forms of excitation, affect the rectum and bladder in the same manner. Excessive sexual excitement produces inactivity of the rectum and bladder, and these organs are among the first to be affected in tabes dorsalis. Such facts are useful, as illustrating the effects of parturient excitement upon the spinal endowments of the other organs of the pelvis.

The lower part of the spinal marrow may be considered as the analogue of the medulla oblongata. In the one, there are congregated the keys of the motor arcs of deglutition, inspiration, expiration, closure of the eyelids, &c., with all their various morbid actions; and in the other, the centres of the motor acts of parturition, defæcation, micturition, and conception, as far as the pelvic organs are concerned. Probably in the interval between these two congeries of reflex spinal arcs in the medulla oblongata and the inferior medulla spinalis, the cervical and thoracic portions of the spinal marrow are devoted to the reflex arcs belonging to the trunk and the upper extremities. The excitor nerves of defæcation and micturition are also in relation with the centre of the reflex respiratory actions in the medulla oblongata, and thus the expiratory actions excited in defæcation and micturition are to be explained. The reflex arcs concerned in parturition are still more extensively diffused. The vagina, the uterus, and the ovaria, are, as we have seen, in relation with the spinal marrow through the medium of the sacral, lumbar, abdominal, and probably also the thoracic intercostal nerves. The actions excited in parturition are numerous in a corresponding degree, and we may compare parturition in some respects to respiration in the libellula, where each segment of the insect is a centre of respiratory action. There is another point of view in which we may consider these reflex arcs of the medulla oblongata and the lower medulla spinalis. In those of the invertebrata which admit of separation into distinct segments, each of which may live as a distinct animal, every ring possesses an independent centre of physical motion. As the vertebræ of the vertebrata, are analogues of the rings of invertebrate animals, there should also belong to each vertebra the representative of a spinal centre. Are not the reflex arcs collected together in the medulla oblongata the spinal centres of the cranial vertebræ? and are not the reflex arcs of the lower medulla the spinal centres to the pelvic rudimentary vertebræ? This view brings the reflex motor arcs of the spinal centre into harmony with the splendid ideas of Oken, Goëthe, and their distinguished successors in archetypal anatomy.

LECTURE XII.

REMARKS ON PERIODICITY. RECIPROCAL ACTIONS BETWEEN THE OVARIA, UTERUS, AND MAMMÆ. NEURAL ACTIONS OF A PHYSIOLOGICAL KIND BETWEEN THE ORGANS OF REPRODUCTION. EXPLANATION OF THE CATAMENIAL PERIODICITY. EXPLANATION OF THE PERIODICITY OF GESTATION. EXPLANATION OF THE PERIODICITY OF LACTATION. THE GREAT GENESIAL CYCLE. OBJECTS OF THE PERIODIC ARRANGEMENTS. PRACTICAL APPLICATIONS.

We have now reached a point in the present course of Lectures, from which we can conveniently glance back upon parturition, gestation, conception, and menstruation, or ovulation. One thing must have struck you in our progress hitherto—namely, the periodic times observed in all that relates to Genesis, and Reproduction in the human subject. I wish to carry your attention backwards, in order to show you something more of the intimate nature and cause of the genesial periodicities than I was able to introduce when treating of Menstruation and the Cause of Labour.

The renewal of the teeth; the appearance of puberty; and many other phenomena which have been generally considered as periodicities, are not really so; they are rather phases of development, similar to the changes of the tadpole from the fish to the air-breathing state, or to the metamorphoses of insects. Once passed, they do not return to start again from the first point, to complete the same process afresh. Even sleep s modified by so many circumstances as scarcely to deserve being classed with the real periodic phenomena. The true periodicities seem to be the catamenia and the other events n the female processes of reproduction. These are almost the only pure physiological periodicities, and there is nothing at all like them in the male subject. There are, in fact, no strictly periodic phenomena of a physiological type in the male economy. The distinct periodicities of intermittent and remittent fevers, and the more indistinct periodicities of other fevers and paroxysmal diseases, are common to both sexes; but these are all pathological phenomena.

In the human subject, the catamenia return every twenty-eight days, reckoning from the commencement of one flow to the commencement of the next. In the inferior animals the return of ovulation occurs in some at longer, in others at shorter intervals. In a great number of cases in all classes of animals the return is annual. Here the periodicity, if it can be so termed, often depends on the return of spring and the solar warmth; these instances are therefore not strictly comparable with those cases in which the ovular periodicity has a shorter interval, and in which it is independent of season and temperature, as in the human subject.

The following arrangement of the principal facts relating to the periodic acts of the three important organs of the human sexual system, will introduce and exemplify the observations I shall have to make on the cause of the periodic phenomena of the sex.

I. OVARIAN ACTIONS.

1. *Actions of the Ovaria upon the Mammæ.*

Irritation of the ovaria at the catamenial periods excites tumidity and pain in the breasts. An altered state of the mammæ is one of the first indications of ovarian excitement. In dysmenorrhœa, the painful state of the ovaria is accompanied by mammary pain. The development of the ovaria calls forth the development of the mammæ at puberty. In those cases in which lactation and ovulation proceed simultaneously, the state of the ovaria, at each recurring period, influences the mammæ, producing a larger flow of milk; a fact I have already mentioned, when speaking of abortion and its causes.

2. *Actions of the Ovaria upon the Uterus.*

It is to the excitement of the ovaria at their periodic times that the secretion of the catamenia by the uterus is owing. At the time of puberty, the development of the ovaria is the cause of the development of the uterus; in congenital absence of the ovaria, the signs of puberty do not appear, although there may be a perfectly formed uterus. The instance on record.

II. UTERINE ACTIONS.

3. *Actions of the Uterus upon the Ovaria.*

Irritation of the uterus and utero-vaginal passage produces inflammation of the ovaria; this is frequently seen in abandoned women, in whom the Fallopian tubes are often adherent to the ovaria from inflammatory action. During pregnancy, the actions going on in the uterus modify the ovarian function. The periodic excitements are masked, or altogether absent; the maturation of the corpus luteum apparently taking the place of the maturation of ovules.

4. *Actions of the Uterus upon the Mammæ.*

It is to the state of the uterus at parturition that the secretion of milk in the mammæ is due. At every catamenial period, the state of the uterus re-acts on the mammæ, increasing the mammary pain and tumidity. In irritation of the utero-vaginal passage in leucorrhœa or gonorrhœa, or in cases of uterine tumours, milk is frequently secreted in the breasts. In cancer, the pathological synergies between the uterus and the breasts are often very strongly marked. The synergic actions between the uterus and the breasts produce, it is well known, one class of the signs of pregnancy. The enlargement of the mammæ, the development of the nipples, and the formation of the areolæ, are examples of this.

III. MAMMARY ACTIONS.

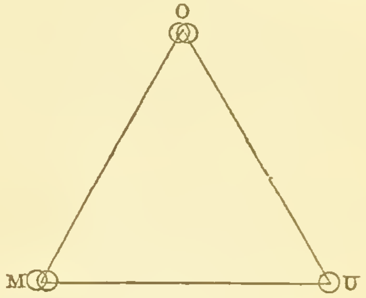
5. *Actions of the Mammæ upon the Uterus.*

Irritation of the breasts excites the uterus in a decided manner, and the application of an anodyne liniment to the breasts will sometimes allay severe uterine pain. The application of a blister, or sinapism, for the purpose of exciting the catamenial flow, have been known to produce irritation and even inflammation of the uterus. The irritation of the uterus, by the sucking of the child, and by the secretion of milk after delivery, I have already adverted to. The production of abortion by irritation of the mammary nerves is a still stronger fact of the same kind. In disease, the synergic action from the breasts to the uterus is quite as definite as that which exists in the converse direction.

6. *Actions of the Mammæ upon the Ovaria.*

The influence of the mammæ upon the ovaria is very distinctly seen, in the arrest of the ovarian periodicity by lactation. As long as suckling is continued, the state of the breasts prevents the processes of ovulation and the catamenial flow. Those cases in which lactation and the catamenia proceed together are exceptions, as much so, as the concurrence of pregnancy and the catamenial flow.

The actions of these three organs upon each other form a physiological Trine, or triangle, which may be represented thus.

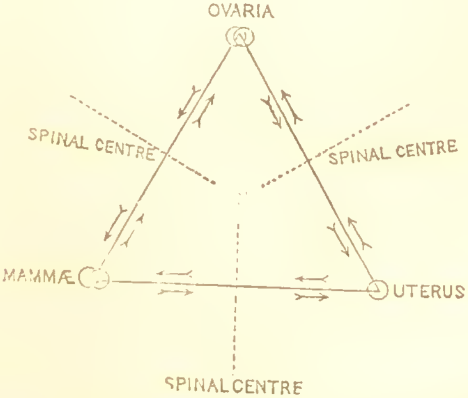


Some of the above facts are pathological, others are physiological; as single facts, they have, many of them, often been considered, but they have never yet been put together by the aid of a constructive idea. I think I shall be able to show you most clearly, that the mere arrangement of them in their proper order gives us at once a beaatiful Theory of the Cause and Circuit of the sexual Periodicities.

The different organs of the reproductive system affect each other in a special and peculiar manner in the causation of their periodic phenomena. The ovaria are the organs in which, during the continuance of the catamenia, the periodicities are most distinctly manifested, though these organs doubtless derive their periodic energies through the medium of the nervous system. We also know that the ovarian periodicity is specially modified by the condition of the breasts and the uterus. There is a remarkable synergic balance preserved between the three great organs of the sexual system—namely, the Uterus, Mammæ, and Ovaria. In the virgin state, the condition of the ovaria at each ovarian periodic excitement excites the uterus to secrete the catamenial flow. When impregnation has occurred, the changes set up in the uterus during the development of this organ and its contents, re-act on the ovaria, and interfere with the ovarian periodicities, so that they become masked during the whole term of pregnancy. At the time of parturition, the ovaria and uterus are the seat of a special excitement, and it is this excitement of the uterus and ovaria which excites the mammæ to the secretion of milk for the supply of the new-born infant. After delivery, the uterus soon returns to a state of comparative repose, but during lactation, the actions going on in the mammæ, like those of the pregnant uterus in ordinary cases, prevent the full development of the ovarian periods. As soon, however, as lactation and the mammary development have ceased, the uterus, breasts, and ovaria, all resume their ordinary periodicity, and ovulation and the catamenial flow proceed regularly until a fresh impregnation occurs. Thus the catamenial cycle of twenty-eight days is departed from at conception for another cycle—namely, that of gestation, which consists of 280 days, or ten lesser cycles. After the completion of gestation, a new cycle is commenced—that of lactation,—upon the completion of which the system returns to the simple catamenial cycle. These cyclical and epicyclical periods are themselves all included in another great period of development, extending from puberty to the decline of the catamenia.

These facts seem to me to be quite adequate to explain the mystery of periodicity, which has hitherto seemed so profound. Let us first take the Catamenial periodicity. We have only to recognise a physiological action in the direction *from* the uterus and mammæ *towards* the ovaria, and the difficulty vanishes. We already recognise pathological actions in this direction in the derangements of the ovaria, caused by irritation of the mammæ and uterus, and unless physiological actions existed, those of a pathological kind could not possibly occur. We know that it is the state of the ovaria at the ovarian period which produces the uterine secretion. This action continues for two, three, four, or five days, or more, and then ceases. Now I believe that during the rest of the days of the catamenial cycle of twenty-eight days, the breasts and the uterus are exerting an influence on the ovaria of a slower and more moderate character, which gradually prepares them for the next ovarian excitement. Thus, in a case in which the catamenial secretion and mammary disturbance lasts four days, there is, so to speak, a neural discharge from the ovaria to the uterus and mammæ during four days. At the end of this time the activity of the ovaria declines, and there is now a neural discharge set up in the contrary direction, so that for twenty-four days the mammæ and uterus are modifying and directing the actions of the ovaria. During the intervals between the catamenial flow, the uterus and mammæ are acting upon the ovaria, causing them to prepare and mature the ovule or ovules of each ovulation, just as, during the days of the catamenial flow, the ovaria are acting on the uterus, causing it to pour out the catamenial secretion—the reason of the distinct ovarian periodicity being, that this action of the uterus and mammæ upon the ovaria is prolonged for a greater number of days than the reaction of the ovaria upon these organs. According to this view, the twenty-four days is as much a periodicity as the four days of the catamenial flow. The twenty-four days are the term of the uterine and mammary periodicity, the four days are the term of the ovarian periodic excitement, and the entire catamenial period of twenty-eight days is a record of the time taken in one revolution of the reciprocal actions of the mammæ and uterus upon the ovaria, and of the alternative action of the ovaria upon the uterus and mammæ. If the catamenial flow had lasted fourteen days, and the apparent quiescence of the uterus had continued just an equal time, the cause of the periodic times of the sex would have been evident long ago; but owing to the disproportion between the uterine and ovarian times, the uterine and mammary phenomena of the intervals between the catamenial flow have never been recognised. All the facts of the case—and they might be multiplied—seem to me to point unequivocally to a power of neural induction, excitation, or polarity, existing between the three principal organs of reproduction, and regulating and producing their functional revolutions or periods, just as simply and decisively as gravitation causes the motions of the planetary bodies.

The following diagram presents a view of all the reciprocal actions which I believe to be constantly going on between the organs of reproduction, through the medium of the spinal centre, and its incident and excident nerves. The facts show that the neural currents, if I may so speak, indicated by the several arrows, are always acting; only in certain parts of the catamenial cycle, the balance is first in favour of one organ, and then of another. Hence arise the special phenomena, such as the act of ovulation and the secretion of the catamenia. These points have been amply noticed by physiologists and obstetricians, because of their prominence, while the other and equally important parts of the catamenial cycle have been quite unobserved. This diagram also applies to the cycles of gestation and lactation; the same neural actions are still, as I believe, proceeding, only modified, so as to give different aspects to the different organs, as the various phenomena of reproduction fulfil their course.



Vicarious menstruation is one of the most singular actions of the economy. Here the synergic actions of the periodic dates, instead of being limited to the ovaria, uterus, and mammæ, extend to some other secreting surface, as, for instance, an ulcer of the leg, or the mucous membrane of the stomach. The ovarian neural energy, upon which the secretion of the catamenia depends, instead of being directed to the uterus, makes an erratic divergence to some distant part or organ.

Cases are on record in which the uterus has been congenitally absent, but in which there were present ovarian pain and irritation, with excitement of the mammæ, at the proper catamenial dates. It has also been said, that the catamenial flow may occur regularly in the absence of the ovaria; this has not, however, been clearly proved. The periodic ovarian excitement, in the absence of the uterus, would probably depend on the mutual actions still proceeding between the mammæ and ovaria. If the catamenia *can* ever occur without the existence of the ovaria and ovarian irritation, the periodicity must be kept up by the actions of the mammæ and uterus. When there is congenital or other deficiency, either of the ovaria, uterus, or mammæ, in the human subject, the economy is reduced to the condition which obtains naturally in birds, where the periodicities, so far as they are independent of external circumstances, must depend on the mutual action of two organs only, the ovaria and the oviducal apparatus.

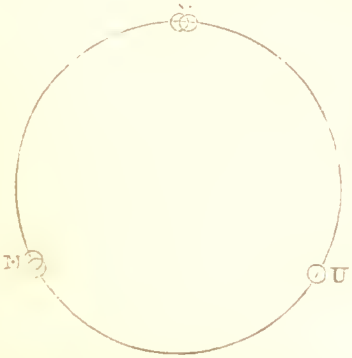
Let us now apply these views to the phenomena of Gestation. For ten periods the ovaria remain comparatively quiescent; the return of the ovarian excitement is often perceptible, but it is nothing like, in intensity, the excitement of the true periodic excitements before the time of impregnation. When the periodic ovarian excitement is very manifest during pregnancy, it is morbid rather than physiological. Throughout the whole of gestation, there is an equable continuous influence exerted by the uterus upon the mammæ. But the uterus is the organ chiefly acted upon: the mammæ and ovaria appear to be acting upon it during the whole period, in much the same way that the uterus and mammæ are acting upon the ovaria in the unimpregnated state in the intervals between the catamenial flow. The answering actions of the uterus upon the ovaria are very slight, producing the indications of the periodic dates, but becoming more faint as pregnancy advances. The uterine synergy, instead of promoting ovulation, seems now directed to the maturation of the corpus luteum. But at the end of the tenth ovarian period of gestation, the accumulated influence of the uterus and mammæ excite the ovaria, and these organs in turn re-act on the uterus, just as at a true ovarian period, but with more force, exciting not only the uterine secretion, but setting up the motor actions of parturition. Thus the action of the uterus upon the ovaria, during gestation, is similar to the action of the uterus upon these organs in the intervals between the catamenial flow; and the action of the ovaria upon the uterus, at the time of labour, is like the ovario-uterine action of the simple ovarian period.

A similar application of this theory of periodicity may be made to the phenomena of Lactation. During the predominance of the mammary function, in strictly healthy subjects, the uterine and ovarian functions remain almost entirely in abeyance. The actions between the uterus and ovaria, and from the mammæ towards these two organs, are at their minimum; the ovario-uterine actions are directed continuously to the mammæ, as the centres of the system of reproduction for the time being. In those cases, too, in which there are slight signs of ovarian excitement, or the occurrence of the catamenial flow at each period, the ovario-uterine excitement of the mammæ, and its influence upon the secretion of milk, is very remarkable. Many women, who do not menstruate during pregnancy, observe the regular excitement and increase of the mammary secretion, at what would have been the catamenial periods. The predominant action during lactation is from the uterus and ovaria towards the breasts, and this action more than neutralizes, in healthy persons, the converse action between the mammæ and the uterus and ovaria. It is the development of the ovaria at puberty which sets the catamenial cycle in motion; while the impregnation of the ovule at the time of conception causes the divergence into the larger cycles of gestation and lactation.

These views apply to all the periodic phenomena observed in the functions of reproduction in mammalia, particularly to the phenomena of œstruation, gestation, and lactation. In all probability, the periodic shedding and reproduction of the antlers of the stag, the shell of the crab, the spines of the porcupine, and the moulting of the feathers in birds, with many other kindred phenomena in the different classes of animals, are also caused by actions and reactions similar to those which maintain the periodicities of the human subject. But I only allude to these matters incidentally, my immediate purpose being the explanation of the periodicities of the human female.

In the unimpregnated state, when the catamenia are regular, the mutual actions and re-actions between the uterus, breasts, and ovaria, proceed regularly, preserving each organ in its physiological condition. At this time the Ovaria are as it were the centre of the sexual system. The sum of the actions is to keep up the periodic maturation and dehiscence of ovules from the ovaria. To this the actions of the breasts and uterus all tend. When impregnation has occurred, the mutual actions still go on between the three organs; but the Uterus has now become the sexual centre, the actions of the breasts and ovaria all tending to promote the development of the uterus. During utero-gestation the ovaria and mammæ remain comparatively quiescent. This state of things continues for ten sexual periods, until the phenomena of parturition occur. Another change now supervenes; the reciprocal actions continue under a fresh aspect, and the Mammæ now become the centre of the sexual organs, every action becoming subservient to the maintenance of the mammary glands in the secreting condition. Probably the physiological times of lactation are also multiples of the catamenial period, equalling the duration of pregnancy. In the human subject the duration of lactation is uncertain, being modified by many causes; but in comparative lactation the time is more definite. During the continuance of lactation, the peculiar relations of the breasts, ovaria, and uterus, are preserved, but in a modified form. On the completion of this process, weaning takes place, and the reproductive system returns to the condition natural to the unimpregnated state. The Ovaria again become the physiological centre of the reproductive organs. The lesser physiological trine formed by the three organs concerned in the catamenial periodicity, is not more remarkable than the greater physiological trine formed by the successive advance of the ovaria, uterus, and mammæ, to the first place in the circle during the course of reproduction. Thus in the unimpregnated female the sexual cycle is formed entirely by the catamenial period; every twenty-eight days the same process is repeated, and the same course pursued. In the married female, during the reproductive epoch, the sexual cycle would include the catamenial period, and also the periods of gestation and lactation. This would make one ovarian month for the period preceding conception, ten ovarian months for the duration of pregnancy, and ten ovarian months for lactation, if we give the same time to this process as to gestation, making, altogether, twenty-one ovarian months. Thus the larger Genesial Cycle would consist of twenty-one ovarian periods, or 21 × 28 = 588. At the expiration of 588 days the sexual system would recommence the catamenial process, to proceed anew in the same order, just as, according to the Metonic cycle of the moon, this planet returns to the same point of the day and hour every nineteen years; the fact upon which the golden numbers of the calendar depend.

The following figure is intended to express the functional revolutions of the Ovaria, Uterus, and Mammæ. In a perfectly physiological state of the organs, one revolution or larger cycle is fulfilled by each fertile ovulation, gestation, and lactation, which occurs during the reproductive epoch.



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We can now trace the mutual dependence of the links in the chain of causes which connects all the chief phenomena of reproduction. We can observe how the development of the ovaria at puberty sets the catamenial cycle in motion, consisting of the actions of the ovaria, uterus, and mammæ. The first ovarian excitement, which probably appears in the usual course of growth or development, is, by the actions and re-actions it excites between these three organs, the cause of all the phenomena, not only of the first catamenial cycle, but of all the purely catamenial periodicities which occur in the unimpregnated state, from puberty to the decline of the catamenial function. Again, we may perceive how upon the act of impregnation another stimulus comes into operation, which in its turn sets the cycles of gestation and lactation in motion. The ovario-uterine excitement produced by the impregnated ovule supplies the momentum, which, acting and re-acting between the reproductive organs, is the cause of the periodic phenomena of gestation and lactation, including the cause of labour, and the first secretion of milk in the mammæ. Upon the conclusion of the cycles of gestation and lactation, the stimulus imparted at conception having exhausted itself, the organs of reproduction again fall back upon the catamenial periodicity.

These actions are, as it appears to me, dissimilar to reflex actions, and they may be referred to a general Law of action and re-action in the animal economy. They are themselves the result of a triple synergy, united and tied together, as it were, by the spinal centre, and involving neural actions to and from the nervous centre, and between the organs themselves, in no less than twelve different directions, which, balancing and controlling each other, regulate the functions of the three organs in their alternating states of rest and activity. These directions are marked by the arrows in the triangular diagram. The whole would seem to be an arrangement for giving as much simplicity and harmony to the sexual system in the state of segregation in which it exists in the higher animals, as is found in those lower animals in which the reproductive faculty is confined to one organ—namely, the ovarium. By this tri-synergic and tri-cyclical arrangement, the triplicate system of the human female approaches towards Unity. The uterus and ovarium are joined together, and the most distant organ, the mamma, becomes a strictly accessory structure to the ovario-uterine canal. Another result of this arrangement is, that in the higher animals, the sexual system, instead of being dependent on the seasons, or on other external circumstances, is self-regulated, and brought into the reproductive condition at frequent and regular intervals.

These views are capable of extensive practical applications. I see many modes in which they may become useful in the treatment of disorders of the catamenial function, sterility, and impotence. They will also prove of importance in elucidating the nature of many disorders of the reproductive periodicities. For instance, by their aid we can more readily understand how, in the case of sudden suppression of the catamenia, the ovarian neural energy may take a morbid direction, and be the cause of disease in some distant organ, as the brain or lungs. Such an occurrence must be considered, not only as the arrest of a single secretion, but as a violent disturbance of the cycle of the catamenial actions. A great part of the pathology of hysteria consists in interruptions of the catamenial cycle. In abortion, too, there is not merely the immediate disorder, the loss of blood, &c., but there is the sudden stop put to the cycle of actions proceeding in gestation, and, also, to the larger genesial cycle. Again, in cases in which lactation is improperly avoided, these views show very clearly that the genesial cycle is suddenly perverted. In such cases, instead of the mammæ taking their due share in the reproductive cycle, the uterus and ovaria are turned back prematurely to the functions of ovulation and the catamenia. Doubtless Nature intended that in the larger genesial cycle, the ovaria, uterus, and mammæ should have their alternate periods of repose. This intended rest to the uterus and ovaria, after the formidable efforts of gestation and parturition, is entirely frustrated by the practice of hired nurses. The result is seen n an increased predisposition to uterine and ovarian disease. Each genesial cycle is a shock to the constitution, and whenver it is cut short by the avoidance of lactation, it is likely o return again too quickly, and before the reproductive rgans are ready for the new effort. The time of lactation, lthough a drain to the general constitution, is a time of rest o the uterus and ovaria! I dwell on this point, because a physical argument is often more powerful than a moral one. I am here, of course, speaking of healthy persons, who avoid the healthy duties of nursing, from fashion or convenience. There are many delicate mothers, to whom the exhaustion of nursing would be most injurious—who are not, in fact, robust enough to pass through the full genesial cycle; but it is precisely in such cases that the period of rest from pregnancy which Nature has provided for in lactation, is most especially necessary; so that gestation should at least be avoided by them for a term equal to that of lactation.

Many other applications will readily suggest themselves. By an extension of the same principle as that which I have been tracing between the organs of reproduction, I think we may acquire a better knowledge of Intermittent Fevers, perhaps of Asiatic Cholera itself! I would fain hope, that besides the study of their causes, the publication of the Periodoscope, which is both a diagram of the reproductive cycles, and an instrument for measuring them, will give a new impulse to the observation of the times of the sexual periodicities. On this point I cannot do better than quote the words of Lord Bacon: " The forces and motions of things operate within certain spaces that are not indefinite and casual, but determinate and finite; and the due observation of these spaces, in every subject of inquiry, is of great importance in practice."

LECTURE XIII.

THE FIRST EXTRA-UTERINE PHENOMENA OF RESPIRATION AND THE ATTENDANT CHANGES IN THE FŒTAL CIRCULATION. ARREST OF PLACENTAL RESPIRATION, AND OF THE UTERO-PLACENTAL CIRCULATION. ESTABLISHMENT OF RESPIRATION IN THE INFANT. ASPHYXIA NEONOTARUM. MOTOR PHENOMENA OF THIS STATE IN DIFFERENT ANIMALS. OPINIONS OF VOLKMANN, DR. MARSHALL HALL, AND EDWARDS. TREATMENT OF CONGENITAL ASPHYXIA BEFORE BIRTH AND SUBSEQUENT TO DELIVERY. INTRA-UTERINE CAUSES OF ASPHYXIA. SEPARATION OF THE CORD. SECONDARY ASPHYXIA.

Excitation of the incident nerves of respiration is the first phenomenon of extra-uterine life. This leads to the motor acts of respiration, the expansion of the lungs, and the establishment of the chemical changes between the oxygen of the air and the blood of the infant. In ordinary cases, the contraction of the uterus upon the placenta, which ensues immediately after birth, very much interferes with the utero-placental circulation, and consequently diminishes the capabilities of the placenta as a respiratory organ. Sometimes the last expulsive action of the uterus in delivery, severs the placenta from the uterus altogether. Thus the changes which naturally occur n the uterus and placenta at the moment of birth, either at once diminish or entirely arrest the vascular and respiratory onnexions between the mother and child. The changes which occur in the infant have precisely the same tendency.

When respiration is established, the expansion of the lungs, esides the formation of new channels in the pulmonary rteries, produces the pressure of the left bronchus upon the ductus arteriosus, which contributes to its obliteration. The altered position of the heart, produced by the sudden expansion of the lungs, probably aids mechanically in the closure of the foramen ovale, and the liver necessarily descends so as to exert pressure by its anterior edge upon the umbilical vein. All these adaptations concur to establish the new circulation, and to arrest the maternal and fœtal circulations in the placenta.

Everything relating to the safety of the new-born infant depends upon the synchronous, or nearly synchronous occurrence of these changes. If the utero-placental circulation and respiration be impeded seriously before the time of birth, the infant is born in a state of partial or entire asphyxia. If the respiratory acts of the infant do not ensue properly at the time of birth, the placental connexion with the maternal system being cut off, the child slowly passes into asphyxia. Before proceeding to the treatment of these, the two forms of Asphyxia Neonotarum, it will be useful to refer more particularly to the establishment of respiration in the new-born infant.

Legallois, Sir Charles Bell, M. Flourens, and Professor Müller, all consider the Medulla Oblongata the *primum mobile* of respiration. Professor Müller also broached the particular hypothesis, according to which, the first respiration of extra-uterine life is excited by the circulation of oxygenated blood in the medulla oblongata. But the fact that a motor act of inspiration is necessary before the first oxygenation of the blood in the lungs can take place, is sufficient, as Dr. Baly has ably argued, to set aside this opinion of Professor Müller.

Dr. Marshall Hall has, moreover, shown by experiment and observation, that the first physiological act of respiration is excited by the impression of the external air upon the excitor nerves of the surface of the body, and especially upon the trifacial; respiration being continued subsequently, in so far as it is an excito-motory act, through the medium of the pneumogastric nerves, in addition to these and other excitors.

To the same physician we owe the distinction between the reflex motor acts of respiration and those respiratory acts which are of centric spinal origin; centric respiratory acts being those which are excited by certain changes induced in the medulla oblongata itself, by various causes, such as excessive abstraction of blood, or the circulation of venous blood only, in the spinal centre.

All the movements of Asphyxia after the occurrence of insensibility, whether convulsions, spasms, &c., are of this latter, or centric character; and as I suppose this fact capable of application to the explanation of the first respiration of the infant, in many instances, I shall enter a little into detail upon the subject of asphyxia in newly born animals.

Dr. Marshall Hall, in his New Memoir on the nervous system, remarks, "If, in a young kitten, we remove the cerebrum, divide the pneumogastric nerves, and open the trachea, we may perceive a slow but rhythmic respiration without any abnormal appearance. If we now close the trachea, all is changed; the animal opens its mouth wide, or *gasps*, makes a strong effort at *inspiration* and *expiration*, is drawn together, and variously convulsed. If we remove the obstruction to the entrance of air into the trachea, the same slow but rhythmic respiration is established as before. If we again close the trachea, we have again the special phenomena of asphyxia."

"If we immerse a young kitten in water of 98° Fahr., we irst observe voluntary movements, being attempts to escape; hen there is a transitory calm; then there are, from time to time, gaspings, attempts at inspiration, followed by forcible expirations, with the escape of bubbles of gas, with mucus, and perhaps blood, from the lungs, and sometimes of milk from he stomach, and convulsive flexure of the trunk of the animal."

In the first case, it appears to be the centric efforts at inpiration and expiration which re-establishes the respiration n removing the obstruction to the entrance of air into the rachea; in the second, it is a similar centric action which nduces the ineffective and gasping efforts at respiration in he drowning kitten.

The fœtus in utero has its blood arterialized, though imerfectly, by gaseous endosmose and exosmose between the maternal blood in the placental cells and the umbilical vessels. When its connexion with the utero-placental circulation in any way suspended before extra-uterine respiration has ommenced, the infant is in precisely the same condition as the kitten with its trachea closed, or when immersed in water.

The following remarks of Professor Volkmann, which have a very interesting bearing on this point, are quoted by Dr. M. Hall.

"When I opened the eggs of fowls or of snakes, containing a sufficiently developed embryo, under water, movements were manifested which resembled gaspings for breath, forcible stretching of the neck, apparently painful turnings and twistings of the body, (but not convulsions,) in short, motions bearing the closest resemblance to the respiratory in asphyxia. These motions, which, in my investigations of the development of the snake, I frequently had occasion to observe, do not, indeed, take place immediately after the opening of the egg, but after some time; they also continue to increase in vigour for a certain time, and in the interval the fine red colour of the blood changes to a purple. The observations of my former assistant, Dr. Schneider, are still more important. The latter cut out of the body of a hare, recently shot, some perfectly mature young ones. At first, the little animals lay in the transparent membranes as if dead; they then began to move, and their motions so much resembled those in asphyxia, that he quickly opened the ovum, in order to save the young creatures. The same gentleman repeatedly observed the birth of puppies. These are brought into the world uninjured, and lie at first quite motionless. After some time, movements commence, and the mother usually awaits this moment to bite off the ovum."

Professor Volkmann also relates the following experiment:—

"I removed the brain of a kitten, with the exception of the medulla oblongata, cut the vagus on both sides, and extirpated the lungs, preserving the diaphragmatic nerves. The breathing, however, continued for forty minutes after the removal of the brain! Did I not fear to engage in theoretical views, (hereafter to be developed,) I should say that the inspirations were increased in vigour after the removal of the lungs. In every case the movements were very energetic, the diaphragm was powerfully contracted, the thorax strongly elevated. I repeated the experiment on several puppies, with exactly similar results. In reality, the experiments contain nothing unexpected; for it has long been known that a separated head will continue to breathe for a certain time; in young rabbits, I witnessed it for seventeen minutes after decapitation."

Dr. Marshall Hall observes, that Professor Volkmann does not here, or elsewhere, distinguish between the *physiological* acts of respiration, which are *reflex* in their nature, and the respiratory acts occurring in asphyxia, which are *centric* and *pathological.* In an infant newly born, the impression of the external air upon the skin, and particularly the afflation of air upon the face and the anterior surface of the chest and abdomen, excites the first respiration as a purely reflex act, the trifacial and spinal cutaneous nerves being the excitors, the medulla oblongata the centre of the nervous arc, and the respiratory nerves of Sir C. Bell, the motors. This form of respiration goes on quite irrespective of the circulation in the umbilical cord. The permanent establishment of the pulmonary circulation, it is true, checks mechanically the placento-fœtal circulation; but in the first period of extra-uterine life, we may often observe respiration and the umbiical circulation going on at the same time. For a brief space only, pulmonary and placental breathing proceed simultaneously.

If respiration be not established as a purely reflex act, another distinct series of phenomena appear. The infant may be born enveloped in the membranes, or it may be born under the bedclothes, where, owing to the warm temperature, and the exclusion of the external air, it is placed n circumstances highly unfavourable to the commencement of reflex respiration. Here the infant lies perfectly till as long as the umbilical circulation and the utero-placental circulation remain unimpeded. When either circuation of the placenta is arrested, the infant may slowly pass into a state of true asphyxia, though it has never yet espired. It begins to writhe and gasp in the same manner s the mature ovum of the bird or snake when immersed in water, or like the fœtus of the hare while enveloped in the membranes. If the human fœtus should happen to continue within the membranes, and these are not opened, it passes nto perfect asphyxia, and perishes—a case which has actually ccurred; if its mouth and nostrils remain free, and excito-motory respiration does not occur, from the absence of sufficient external impressions on the excitor nerves, the gasping acts of inspiration and expiration may themselves pass into natural acts of respiration, and so preserve the infant. The centric respiratory acts due to the influence of unarterialized blood on the medulla oblongata, are gradually changed into those normally excited by the pneumogastric nerves, in consequence of the flow of blood into the lungs, and the impression of carbonic acid upon the terminal fibres in the air cells. Thus, then, in addition to the *physiological* provisions for the establishment of extra-uterine life by the reflex actions, there is in the *pathology* of asphyxia, the cause of death where the reflex acts do not occur, a new and beautiful provision for the preservation of the offspring of animals, in this centric excitement of respiratory movements.

Asphyxia from interruption to the placental circulations, either by continued contraction of the uterus, detachment of the placenta, or pressure on the umbilical cord, is the common form in which death takes place in the fœtus in the latter months of pregnancy, or during parturition. Without doubt, whenever death occurs from this cause, the convulsive action and the respiratory movements of asphyxia precede it. Hence it was that the mature embryo appeared to Leelard to breathe in the liquor amnii, and to inspire fluid instead of air. In his experiments, the respiratory movements of the fœtus within the membranes were visible to the naked eye, and matter injected into the amnion by a small orifice was found in the lungs. Hence, also, it is, that in certain eases respiration is established during labour, while the fœtus is yet in the womb, or while passing through the vagina. In cases of vagitus, the child must have breathed before it could cry; we can hardly believe the first act of respiration in such cases is of a reflex kind; but the transition of the centric respiratory acts of asphyxia into acts of normal respiration, when it is possible for air to reach the mouth, is readily comprehended, if we perceive the nature of the physiological and pathological causes of the first respiratory movements.

It is worthy of remark, that in that stage of asphyxia in which convulsive movements and gasping efforts at inspiration and expiration take place, the reflex motor system of nerves is endowed with greater excitability than at other times. This is a point which has been particularly insisted on by Dr. Marshall Hall. Slight excitation produces striking respiratory and other movements. The young of animals, during their early extra-uterine life, are in a state approaching to partial asphyxia, and Dr. Marshall Hall has remarked, that the excitability of the incident nerves of respiration are greater in proportion, the sooner they are observed after birth. The elaborate researches of Dr. Edwards show that asphyxia takes place more slowly in animals which are born in a state of comparative immaturity, as the kitten, than in those which are more mature at the time of birth, as the guinea-pig. The infant is between these animals as regards maturity at birth, and as regards the length of time it may be deprived of placental or pulmonary respiration without perishing. A child born prematurely, is asphyxiated more slowly than one born at the full time; and it is well known, that a child which has not yet breathed bears the deprivation of air for a considerable time without dying, while a child who has once breathed dies almost instantly on the arrest of respiration.

Thus, then, we are led to the conclusion, that the medulla oblongata may, in some cases, be the *primum movens* of respiration. But this does not in any way invalidate the application of the discovery of Dr. Marshall Hall to the establishment of natural respiration as a *reflex* act. The centric development of respiratory action by centric stimulus is pathological, or supplemental, to the normal process. All pathological actions whatever, are probably nothing more than attempts to perform physiological actions under difficult or impossible circumstances. In the instance under our consideration, they sometimes end in the death, and in others, are the cause of the preservation of the infant. It must be remarked of Professor Müller, that not only is the hypothesis of this distinguished physiologist unfounded, but the exact converse appears to be the truth. When the medulla oblongata does happen to be the *primum movens* of respiration, it is venous and not arterial blood which acts as the stimulus to the spinal centre.

I am not now describing a rare exception, but a very common occurrence. In a great many labours, and indeed in all in which the propulsive and expulsive stages have been severe, the child is born in a state of semi-asphyxia. Respiration is established in such cases partly as a reflex act, and partly by the gradual passing of the respiratory movements of asphyxia into those of natural respiration. A child born after an easy and moderate labour cries almost at the instant of birth, the external air, the touch of the bed-clothes, and the manipulations of the accoucheur, are sufficient to excite respiration, and to keep up the respiratory movements without intermission. In a child born after a difficult and prolonged parturition, the skin is generally turgid and empurpled, from the imperfect placental respiration which has been going on during its passage through the uterus and vagina; it does not cry or move at the time of birth, but at intervals of half a minute, or a minute, or even longer than this, it gives an asphyxial gasp, and is then perfectly still again. Where the asphyxia is not complete, these gasps become more frequent, and gradually pass into ordinary rhythmic respiration. The establishment of respiration is aided by the reflex movements excited by external impressions, and which mix themselves with the asphyxial gaspings. Thus there are two modes in which respiration may be established: the first and purely physiological, by impressions on the incident excitor nerves, and the corresponding respiratory movements dependent on the medulla oblongata and the motor nerves of respiration; the second, by impressions made on the medulla oblongata, the nodus vitalis, and centre of respiration, by venous blood, and which are of a pathological character, but which yet excite respiratory movements through the medium of the respiratory motor nerves. Even in the pathology of asphyxia, there would seem to be a provision for the preservation of life. In other cases, where the child is feeble and small, or where the causes of asphyxia have been long in operation, the gasps become weaker and occur at longer intervals, till at length the respiratory movements disappear altogether, the heart ceases to beat, and the child is dead. In some cases of this kind, the most energetic and careful means of resuscitation are of no avail. If reflex action of the respiratory muscles be induced, it consists of one inspiratory gasp at each excitation, after which the asphyxial movements proceed as before. Such cases are very embarrassing to the practitioner. The child is seen by those around to be alive, from the movements which occur, and there is risk of censure if the recovery cannot be effected. But the fact is, mature infants may be born *living*, but not viable; or rather, they are born *dying*, and so far advanced towards dissolution, that no art can recal them to life. Without thoroughly understanding the physiology and pathology of the first respiration in new-born infants, it is impossible but that you should feel misgivings when fatal cases occur to you, misgivings lest you should not have done enough, or have done rightly.

These physiological and pathological data are of great practical importance; they must form the very basis of our treatment for the resuscitation of still-born infants. In the measures taken for their recovery, both the *reflex* and *centric* modes of inducing respiration must meet with due attention. With respect to the former, Dr. Marshall Hall has, with admirable conciseness, laid down the plan to be pursued.

"The most important of all our remedies in congenital asphyxia is the sudden and forcible impression of cold water on the face and general surface. The quantity of water should not be great; but it should be applied suddenly, and with force. The temperature should not be lowered; on the contrary, the dashing of the cold water should be alternated with a warm bath, succeeded by warm flannels. These, too, may be applied briskly and suddenly. The efficacy of the remedy is in proportion to the degree, the suddenness, the energy of the *alternation*. Continued cold depresses the energies of life, continued warmth augments them. But it is the sudden impression arising from the brisk alternation of the cold and heat which proves the most efficacious excitor of the respiratory function, on which recovery depends immediately.

"Other excitements of the surface should also be applied. In our experiments on kittens, we uniformly found, that to pinch the tail, the feet, the ears, or the general integument, with the forceps, did not excite other reflex actions only, but acts of inspiration! We must imitate these facts. The face and the general surface should be rubbed roughly, irritated by a knitting-needle, and struck smartly with the open fingers. The nostril and the anus are most excitable parts. Irritants must, therefore, be applied to these parts from time to time.

"These means become more effectual after the lapse of an interval of repose. During such an interval, which obviously must not be too long, the infant must be placed in a warm bath, and be afterwards rubbed with warm flannels. The sudden dashing of cold water will then especially be doubly efficacious.

"These plans of resuscitation should not only be long continued, but they should be continued long after the apparent institution or restoration of respiration, with the object of preventing a relapse into *secondary asphyxia.* Perseverance is not less necessary in this case than in that of poisoning from opium. The blood is still poisoned, and a slight comparative failure in the respiration, as from sleep, may add to the dose of poison, and prove fatal. My friend, Mr. Henry Smith, has made a most important remark:—*After* inflation of the lungs, secondary asphyxia may prove fatal, and the life of a supposed criminal mother may be placed in fearful jeopardy, even by the medical evidence.

"Next to the remedies which have been noticed, the exposure of the face especially to a current of cold air will prove most important; and even after the infant has been restored to animation, and clothed, its *face* should be freely exposed in a cool atmosphere. The fan may also prove of great assistance; the sudden gusts induced by it are especially useful."

These various means all have reference to the excitor function of the *trifacial* and *spinal* nerves; there is yet the other and natural excitor of respiration, the *pneumogastric,* to which to devote attention. This is done by artificial respiration, in which, if successful, the lungs are distended, the heart acts, blood is poured in by the pulmonary artery, the proper chemical changes are effected, and the great internal excitor of respiration becomes obedient to its natural stimulus. Dr. M. Hall recommends that artificial respiration should be performed in the following manner:—*

"The practitioner's lips are to be applied to those of the infant, interposing a fold of linen, and he is to propel the air from his own chest, slowly and gradually, into that of the infant, closing its nostrils, and gently pressing the trachea on the œsophagus. The chest is then to be pressed, to induce a full expiration, and allowed to expand, so as, if possible, to effect a degree of inspiration. But it is important, in doing this, that the practitioner should previously make *several deep* and rapid respirations, and, finally, a full inspiration. In this manner the air expelled from his lungs into those of the little patient will contain more oxygen, and less carbonic acid, and consequently be more capable of exciting the dying embers of life.

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* New Memoir, page 141.

"If all these plans should be tried in vain, I would strongly advise galvanic or electric shocks, to be passed from the side of the neck to the pit of the stomach, or in the course of any of the *motor respiratory* nerves and their appropriate muscles. No time should be lost in sending for a proper apparatus; but should the lapse of an hour, or even more, take place before it *can* be obtained, still it should be sent for, and tried."

The knowledge of the reflex function of the spinal marrow must unquestionably give precision to the treatment of congenital asphyxia. The knowledge of the centric action of this organ, at the commencement of extra-uterine life, will also prove of practical service. Too much cannot be said on the necessity of persevering to the utmost in our endeavours to resuscitate still-born children. The subjects of congenital asphyxia sometimes recover, after every sign of life has seemed extinct. The device of that noble institution, the Royal Humane Society,—a child blowing an extinguished torch, with the motto,

"Lateat scintillula forsan."

is still more appropriate in congenital asphyxia than in the ordinary forms of asphyxia.

The time for dividing the umbilical cord is a point of some importance in children born asphyxiated, or who become asphyxiated immediately after birth, from the non-establishment of respiration. If, in such cases, the connexion between the uterus and placenta continues, the cord should not be severed, in the hope that some amount of placental respiration may go on, and defer the death of the infant, so as to give time for appropriate treatment. Dr. King has advanced the ingenious opinion, that many still-born children perish because they are rendered exsanguineous by the accumulation of blood in the placenta. Without going so far as this, I believe injury may arise from delaying the section of the cord. After the separation of the placenta from the uterus, which we can ascertain by feeling the placenta at the os uteri or in the upper part of the vagina, the continuance of the connexion can be of no use whatever. On the other hand, it unnecessarily increases the labour of the fœtal heart, as, in addition to the proper fœtal circulation, it has to assist in impelling blood into the umbilical arteries, through the placenta, and back again by the umbilical veins. No good, therefore, can possibly accrue to the child from the placental connexion after the separation of the placenta from the uterus, and it may be productive of harm. Whenever the child is dark and turgid at the time of birth, a teaspoonful of blood should be allowed to escape at the time of dividing the cord.

In the last century, Pugh, a writer on midwifery, recommended, in cases of reverse delivery, when the body of the child has been expelled, and the head remains in the inferior straight of the pelvis, that the fingers should be introduced into the vagina, and the index and second finger placed in the child's mouth, in order to establish respiration, a space between the two fingers being made for the admission of air. He pointed out, that unless such means are resorted to, in cases where it is difficult to extract the head immediately, death ensues from pressure on the umbilical cord. He also, in some cases, conveyed a tube, which he describes as being flat and flexible, into the child's mouth, for a similar purpose. Many years after this, Dr. Bigelow, in a most ingenious paper on the subject, described cases in which he had saved the lives of several infants, by establishing respiration in the same manner, while the head lay in the vagina.

Dr. Bigelow observes, that when the head is thus placed, the attendant "is apprised, by a convulsive jerk or spring of the body, that a state of extreme danger exists, and that the time has come at which the child must breathe, or will speedily die. If at this period the fingers be introduced, so as to reach the mouth of the child, it will be perceived that each jerk of the body is attended with a gasp and convulsive effort at inspiration, performed by the mouth and chest of the child. In this state of things, if air be conveyed to the mouth of the child, it will immediately breathe, and the efforts of nature may in most cases be safely waited for to assist in expelling the head."

These convulsive movements, and the gasping attempts at respiration, are no other than the centric movements of asphyxia which I have been describing! It is mentioned by Dr. Bigelow, that the mere admission of air may be sufficient to establish respiration; but this physician further observes, that where the attempts at respiration are imperfect, they may be powerfully assisted by douching the surface of the body of the child with cold water. Here Dr. Bigelow availed himself both of the centric and reflex modes of establishing respiration, and thus practical men are often found in advance of physiology and science; it is, however, scientific principles which can alone render improvements in practice universal: men require to have reasons for acting, in addition to mere empirical success, before they will implicitly follow in any given path.

In all vigorous children who die of asphyxia before delivery these centric attempts at respiration must take place, and would end in the more or less complete establishment of the function, if the access of air could be provided for. Notwithstanding the pressure exerted externally on the thorax by the parturient contractions, it is certain, that in some instances the child breathes and cries while still in the pelvis; probably the number of these cases would be greater if any means were taken to promote intra-vaginal respiration. The cases in which the attempt ought to be made are those in which death is apprehended from continuous contraction of the uterus, detachment of the placenta, whether from the fundus, or the os and cervix uteri, cases of turning, footling or nates presentations, and all other cases in which the placental circulation is interfered with, or in which long-continued pressure on the umbilical cord occurs. Where the feet descend first, we have the convulsive flexure of the body to warn us of the approach, or, rather, of the actual presence of asphyxia, and we can act accordingly; but in head presentations there are no signs of danger, except those to be gathered from the sensations of the mother, and the movements of the mouth of the fœtus. It is extremely probable that mothers are correct in referring the date of the death of the child in utero, at the close of pregnancy, or during parturition, to the time when these movements of asphyxia are felt.

From the time of the full dilatation of the os uteri and the evacuation of the liquor amnii to the birth of the fœtus, the utero-placental circulation is impeded by the greater energy of the uterine contractions, and the diminished size of the uterus; hence the placental respiration of the fœtus is interfered with. It is to the long continuance of this part of labour that the semi-asphyxia so often witnessed is chiefly due. When the membranes rupture before the dilatation of the os uteri, the hazard of asphyxia during the course of labour is of necessity increased. The intervals between the pain in the propulsive and expulsive stages of labour are the breathing times of the fœtus; it is, therefore, of the greatest importance that the pains should not be incessant and continuous. This is one reason why the ergot of rye, which produces continuous contractions, is dangerous to the fœtus, and the more so the earlier it is administered.

In other cases, the danger of asphyxia is increased by pressure on the umbilical cord, as well as by impediment to the utero-placental circulation. This happens in cases of turning, prolapsus of the cord, breech presentations, twisting of the cord round the head or arms of the fœtus, and in cases in which, after delivery of the head, delay occurs in the extrication of the breech and inferior extremities.

It will certainly be proper, in all cases of impaction of the head in the pelvis, separation of the placenta, cord presentation, or continuous action of the uterus, to reach the mouth of the child as soon as possible, and if it be still living, to apply a tube such as that recommended by Dr. Bigelow, in order to facilitate the establishment of respiration in the way pointed out by that accoucheur. The same may be done in cases of turning, where the delivery of the head cannot be immediately effected; for it is well known that in these cases children frequently die who were alive but a few minutes before entire delivery. When the delivery is reverse, and only the head or the upper part of the child remains impacted in the vagina, it must be borne in mind that *the time* for making the attempt to save the child is when the movements of asphyxia, or reflex attempts at respiration, commence. Passing the fingers into the mouth, or the insertion of a tube, will be of no use unless when the centric or reflex efforts at respiration are being made. It will be of little service before these movements occur, unless as a measure of precaution; and when they have ceased, it can be of no use whatever, unless respiratory acts can be re-excited by reflex action; and then we have to deal with complete asphyxia, not simply with the new-born infant who has not yet attempted to respire. In all cases where the body of the child is expelled, and the afflux of air, or the manipulations of the attendant, have excited reflex attempts at inspiration while the head is yet unborn, the mouth ought, if possible, to have air admitted to it either by the fingers or by a respiring tube; otherwise, there is the danger already spoken of—namely, the ingurgitation of the liquor amnii into the lungs.

In cases where the feet and trunk of the child are first delivered, and where the mouth cannot be reached by the accoucheur, all sources of excito-motion should be avoided. This is a point of very great importance. The hands of the attendant should be warm, and the cold should be excluded as much as possible, otherwise forcible acts of inspiration will be induced before air can possibly reach the mouth, and the child may be destroyed by taking the liquor amnii into the lungs instead of air, or it may be exhausted by futile efforts at respiration.

The Secondary Asphyxia, which affects infants and others after their resuscitation, is very remarkable. It is different from asphyxia proper, inasmuch as, though exposed to the air freely, the centric movements do not now end in the establishment of the respiratory process, but in death. Prevention is the thing which should be aimed at, and for this purpose free exposure to cool air, stimulation of the external thorax, and of the trifacial nerve, should be practised. To this end, the nostrils may be irritated with a feather, the soles of the feet may be irritated, the face may be fanned or sprinkled with cold water, and the cool hand may be applied to the chest occasionally, until the respiration is thoroughly established, and the undue quantity of carbonic acid removed from the circulation. It would seem that the cause of death in secondary asphyxia depended on a different cause from that operating in ordinary asphyxia. Mr. Erichsen, in his able essay on asphyxia, in addition to the ordinary modes of treatment, strongly urges the propriety of artificial respiration with oxygen gas; probably as the fœtus is in the condition of a cold-blooded animal, the atmospheric air is as powerful a stimulus to the fœtus as oxygen to the adult. Care, however, should be taken, in breathing into the air-passages of the infant, to render the air of the operator's chest as pure as possible, by repeatedly inspiring and expiring deeply during the process of insufflation.

The entire subject of asphyxia in adults, or those in whom perfect respiration has been established, requires to be studied by the light thrown on the subject by enrachiology. It promises a rich practical harvest to any one who enters on the investigation duly prepared. Physiology and Pathology may both be turned into the channel of Therapeutics.

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LECTURE XIV.

APPLICATIONS OF PHYSIOLOGY TO OBSTETRIC PATHOLOGY AND THERAPEUTICS. DISORDERS ARISING FROM EXCESS OF NERVI-MOTOR ACTION. DISORDERS ARISING FROM PERVERSION OF NERVI-MOTOR ACTION. DISORDERS ARISING FROM DEFICIENCY OF NERVI-MOTOR ACTION. THE RELATION OF NERVI-MOTOR ACTION TO INSTRUMENTAL DELIVERY AND MANUAL OPERATIONS. A NEW CLASSIFICATION OF OBSTETRIC THERAPEUTICS, ETC.

Your attention has hitherto been directed, in the present course, chiefly to the Physiology of Parturition and the subordinate functions of the sexual system; I propose, in future lectures, to dwell more especially on the direct applications of this branch of physiology to Obstetric Practice. I should not have urged the views of nervi-motor action which I have placed before you, so strongly as I have done, had I not believed them to be, beyond all question, rich in these practical applications.

A great many of the complications and accidents of parturition and the puerperal state, met with by the obstetrician, do, without doubt, depend either upon excess, perversion, or deficiency of the nervi-motor actions peculiar to childbearing; and before dealing with them effectively in their pathology and therapeutics, it was absolutely necessary to understand these actions in their physiology.

Let me first briefly refer to those affections which depend upon *Excessive* nervi-motor action, either of the uterus, or of the general nervi-motor system, caused by the condition of the uterus at parturition. In the first place, there is *Precipitate Labour*, which depends chiefly on an excitable condition of the uterus, and which consists of too rapid or prolonged contractions of this organ, and of the associated muscles which contribute to delivery. Another form of excessive action is seen in spasmodic contraction, or *Rigidity of the Os Uteri*—I mean, not the mechanical closure dependant on the unyielding state of the non-contractile tissue of the os uteri, and which slowly gives way under continued pressure, but rather that form of contraction which depends on the condition of its contractile fibres, and which often gives way after long resistance, almost instantaneously. The most common form of *Rupture of the Uterus* is that caused by excessive uterine contractions, the uterus, in fact, rupturing itself by its own inordinate efforts. This form of rupture may either take place in acute labours, when it is often the result of mere force, or in prolonged labours, after the uterus has been weakened either by pressure, inflammatory action occurring during parturition, or a form of softening dependant on long-continued muscular contraction. Then, again, *Laceration of the Perinæum* is another kind of rupture caused indirectly by the excessive muscular efforts of labour. The uterus bears the child upon the perinæum so forcibly and prematurely, as to lacerate this part, purely as the result of mechanical pressure. An excessive action of the uterus in the early stages of labour may be the cause of any, or, indeed, of all these disordered actions. It must be borne in mind, that in all labours not rendered abnormal by mechanical difficulties, there must be some one point in the process, often of the most insignificant kind, from which the departure from healthy parturition takes place, and upon which the accidents of excessive or deficient action follow. The one sole aim of the accoucheur in natural labour, is to keep the process in the purely physiological track. It is impossible to insist too much on this point.

Rupture of the membranes, occurring prematurely, may bring the head of the child into direct contact with the os uteri, and the excitation consequent upon this may either cause rigidity of the os uteri, rupture of the uterus, or laceration of the perinæum; or it may induce any of the other complications dependant on excessive nervi-motor action in parturition. *After-pains*, when present to a morbid extent, are nothing more than a form of excessive nervi-motor action of the uterus, attended by increased sensibility. *Encysted Placenta*, when dependant, as it frequently is, upon spasmodic closure of the os and cervix uteri, also belongs to this class of affections. The sphincteric closure of the os uteri in such cases is similar to spasmodic rigidity of the os uteri, only it is more purely motor, and the one occurs *before* delivery, the other *after* the birth of the child. Another post partum accident, namely, *Inversion of the Uterus*, depends, as I hope I shall be able to demonstrate to you, more frequently upon irregular and excessive motor action of the uterus itself, than upon any mechanical displacement; this inversion is, I am sure, more nearly allied to intus-susception, than to hernia or mechanical prolapse. Introcession of the fundus first occurs, then intus-susception, and lastly inversion. Another form of irregular and excessive motor action produces *Hour-glass Contraction*, or local constriction of the uterus, which takes the place of the uniform contraction of the organ, that should follow delivery. We may aptly compare hour-glass contraction of the uterus to local spasmodic contraction of the intestines, such as often happens in the colon. I have already treated fully of *Abortion*, which is entirely a nervi-motor disorder, belonging to the class of causes I am now referring to; in fact, abortion obviously could not occur without premature, excessive, and spasmodic action of the uterus.

Allied to the excessive actions of the uterus are the general spasmodic or convulsive actions, or the local spasmodic actions, extra-uterine in their seat, which may attend or follow parturition. Such are *Vomiting*, *Strangury*, *Tenesmus*, *Cramp*, and also the *Metastatic Pains*, as they have been called, which, instead of affecting the uterus, expend themselves upon the abdominal, or lumbar, muscles, or the thighs of the patient. I conclude this list of excessive or perverted actions of the muscular system in parturition, with *Puerperal Convulsions*, a disease the pathology and therapeutics of which are essentially nervi-motor, and the treatment of which can at the best be but empirical, without a profound study of the nervous system. The cause of these motor excesses or perversions may be in the state of the circulation, or in the condition of the spinal centre; they may depend on excess of the natural stimulus to parturient action in the parturient canal, or they may be the result of irritation of those extra-uterine excitor nerves, which have the power of acting reflexly upon the uterus, such as the rectum, bladder, and stomach.

Such are the more important accidents and complications of parturition of a motor kind which originate in Excess of the natural actions.

A second class of motor derangements incidental to parturition depend on *Deficient* nervi-motor actions of the uterus and the related organs. Such, for instance, is *Uterine Inertia,* in which the organ is sometimes neither capable of being stimulated by the natural excitants of parturition, nor by any artificial stimulus which we can apply. In other cases, the inertia is not complete, but the uterine actions are so infrequent and feeble as to be the cause of *Tardy Labour.* Such cases are merely the reverse of precipitate labour, the excitability and the motor action being diminished instead of exalted. In cases of inertia or tardy labour, or in those cases in which uterine inactivity has followed upon excessive action, *Sinking* is liable to occur. This state involves, not merely a failure of uterine nervi-motor power, but a general failure of the *vis nervosa,* including respiration and the action of the heart, and, unless arrested by the most vigorous measures, leads to dissolution. In cases of labour in which there is inactivity of the uterus without separation of the placenta, tardy labour with its complications are the sole result; but when this inactivity co-exists with separation of the placenta, or occurs after its exclusion, we have *Uterine Hæmorrhage.* The essential cause of uterine hæmorrhage, whether occurring before or after delivery, depends upon failure of the uterine nervi-motor power. Mere separation of the placenta during the progress of labour would not necessarily cause hæmorrhage, unless relaxation of the uterus occurred between the pains. Where failure of uterine action depends, not upon the absence of nervi-motor power, but upon the absence of sufficient stimulus, the arrest of the hæmorrhage is easy; but when there is also real failure of motor power, the case becomes of a graver kind. There may be combined with, and indeed causing, the hæmorrhage, the same general depression of the nervous system which, in cases where there is no hæmorrhage, results in sinking. Of course the hæmorrhagic complication greatly increases the gravity and danger of these important cases.

In uterine hæmorrhage, and in uterine inertia before delivery, the same essential conditions exist. It is purely accidental that in one case the placenta should be undetached, and that there should be simply an arrest of the actions of labour; while, in the other case, the placenta being severed, the same cause produces the most alarming hæmorrhage which can occur in the living body.

I have here been speaking of hæmorrhage from the fundus and body of the uterus; but there is also the variety of hæmorrhage, depending on the separation of the placenta from the os and cervix uteri—*Placenta Prævia.* These vitally important cases, though produced merely by the mechanical position of the placenta, depend very much, in their treatment, upon the nervi-motor actions of the uterus. There can be no safety until the os and cervix have contracted either upon themselves, or upon the advancing fœtus. Whether these cases are treated by turning, or by the extraction of the placenta, the loss of blood is invariably arrested by contraction, or pressure, or both, and by no other means. Another consequence of failure of uterine action is seen in certain cases of *Retained Placenta*, where the secundines are not separated and expelled from the uterine cavity, from the absence of contractile power. Such cases are exactly opposite to the cases I have already referred to, as caused by sphincteric contraction of the os and cervix, and in which the placenta may be perfectly detached from the uterine parietes, but cannot be expelled. Some cases of retained placenta are known to depend on morbid adhesions of the placental structure to the uterus; but n other cases the placenta is removable, or actually detached, and only waits for uterine contraction and the dilatation of he os uteri, or for mechanical extraction.

In this category of deficient action, I may refer to those ingular complications of labour which depend on paralytic affections. It is well known that labour may occur, more or less completely, in cases of cerebral or spinal paralysis. Cases are on record of perfect or imperfect parturition in women affected with *General Paralysis*, or with *Hemiplegia* or *Paraplegia;* and such cases are most interesting, as throwing a great light both upon natural and morbid labour. In these cases we see the nervous system reduced to its elements still more completely than by the most skilfully devised experiments. Throughout the class of morbid affections dependent on deficient motor action, the deficiency may arise either from inadequate excitor stimulus, or from deficient excitability and motor power in the uterine nervous system.

It often happens that, in the same labour, various morbid complications occur, at one stage depending on excess, and in another stage upon deficiency of nervi-motor action. Thus a rapid and powerful labour may be followed by complete inertia, with hæmorrhage, after delivery. Here the excessive action previous to the birth of the child becomes a cause of the subsequent inertia. On the other hand, a tedious labour, with feeble action of the uterus, may be followed by violent and long-continued after-pains, the tardy progress of the labour having produced such an excitable condition of the utero-spinal system, that slight excitation produces the most severe and painful contractions. Some of the disorders of the reproductive system may be caused both by the exalted and the depressed activity of the motor organs. *Sterility*, for instance, may probably occur either from a state of inactivity or excessive contraction of the Fallopian tubes. I may here mention, incidentally, that I have recently devised and performed a new operation connected with these tubes, for the removal of sterility, which I shall shortly publish.

Such are the principal accidents and derangements of labour of a motor kind which depend on deficiency of the natural actions.

We may divide the motor derangements of Labour into two classes:—

Class I.

1. ABORTION.
2. PRECIPITATE LABOUR.
3. RIGIDITY OF THE OS UTERI.
4. RUPTURE OF THE UTERUS.
5. LACERATION OF THE PERINÆUM, &c.

6. EXCESSIVE AFTER-PAINS.
7. ENCYSTED PLACENTA.
8. INVERSION OF THE UTERUS.
9. HOUR-GLASS CONTRACTION.
10. METASTATIC PAINS.
11. PUERPERAL CONVULSIONS.

Class II.

1. UTERINE INERTIA.
2. TARDY LABOUR.
3. SINKING.
4. UTERINE HÆMORRHAGE.
5. PLACENTA PRÆVIA.
6. RETAINED PLACENTA.
7. LABOUR WITH PARALYSIS.

I have thus shortly grouped together the two great Classes of disordered parturient actions, for the sake of comparison and contrast; those which depend on excess, and those which depend on deficiency, of motor power, the *kinetic* and the *akinetic* affections. I cannot but believe such a mode of viewing them will be more likely to fix the principles upon which they depend, and upon which their treatment must be founded, more firmly in the mind than any isolated consideration of their phenomena. Viewed in the way I have pointed out, one affection becomes the interpreter of another, and we get something like a systematic arrangement, instead of a mere catalogue of disordered actions. Hereafter I shall go into this subject, which I have now only glanced at, more in detail.

I proceed to take a brief view of the relation which exists between nervi-motor action and the various Operations and special Therapeutics on which we rely in obstetric practice. We cannot use the forceps, or give a dose of the ergot, without due reference to the nature and causes of uterine action, and without understanding them, unless we are content to practise empirically. The same intimate connexion as that which I have sketched in the pathology of this department, can be shown to exist throughout the entire armamentarium obstetricum.

How much of the success and safety of *Turning*, for instance, depends on the due appreciation of the motor condition of the uterus at the time of the operation? A familiarity with the various causes of uterine contraction readily enables us to avoid all those which are not inevitable, and to soothe the organ when it is preternaturally excited. In the application of the *Forceps* or the *Vectis*, it is important to distinguish between the mechanical assistance gained by the instruments themselves, and the increased motor action excited by the mere introduction and use of instruments. Laceration and rupture occur quite as often from the excessive reflex actions excited by instruments, as from mechanical violence. These observations apply equally to *Craniotomy,* and the use of the *Crotchet.* In another important obstetric operation, the *Induction of Premature Delivery,* everything is excito-motor. The great object is to apply irritation to the os uteri so as to excite reflex actions of the uterus. This is equally the case whether we puncture the membranes, and thus bring the head into contact with the os uteri, or whether we depend on external orificial irritation. In the most formidable operation within the range of obstetrics—namely, the *Cæsarian Section,* the motor action of the uterus is an important element. If any great improvement in the performance of this operation should ever take place, it will probably depend on the study of the motor action of the uterus with reference to the incisions which are necessary to effect delivery in this manner. At present it is by no means settled in which direction or position the uterus can be opened so as to afford the least risk of uterine or peritonæal inflammation.

In the special Therapeutics of the Obstetric Art, almost everything is nervi-motor. All the *Manipulations* of the accoucheur in examining and assisting the patient, must have reference to the uterine actions they may excite. It should never be forgotten that he has to deal with an excitor surface, and that, too, in a state of high excitability. Every point of the parturient canal, from the ostium vaginæ to the fundus uteri, has its excito-motor fibres, and every digitation we resort to is reflected back in an increase of the contractile pains.

Besides manipulative aid, there are a variety of measures having special relation to motor action resorted to by accoucheurs. If we give an *Enema* during or after parturition, it is not merely the bowel which is evacuated, but the uterus receives its share of reflected excitement. Enemata are, indeed, marked utero-spinal excitants. The *Abdominal Bandage*, too, is not merely a compressor of the abdominal parietes, but by irritating the surface of the uterus, it increases its expulsive efforts. Another very important agent in obstetrics is *Temperature.* This is of immense service in exciting the uterus in its states of inertia, whether in tardy labour or in hæmorrhage. This one subject of temperature, the effects of heat and cold, and of their alternation, upon the parturient uterus, is well worthy of separate study. We have certainly not as yet made that use of temperature which we may easily derive from it. Obstetricians dash cold water upon the hæmorrhagic uterus, but without any reference to principle, either in the application of the remedy or in the physiological action of the organ. In heat and cold, rightly understood, which are always at our command, the accoucheur has his most potent weapons. Another remedy, the *Ergot of Rye*, has been used and abused, but it has never been understood; it is at present a purely empirical drug, and a remedy can only be perfected when we have carried the study of it onwards to its effects, and backwards to its physiological relations. I do not know that it has ever happened to obstetricians to discuss the principle upon which the ergot acts; hence it has been used in a confused manner, sometimes in combination with a mass of other remedies, and sometimes it has been depended on alone, to the exclusion of other applications which should always be used simultaneously with the ergot. The obstetric use of *Opium* is also, up to the present day, a problem. It is by no means settled whether opium acts as an excitant, or as a sedative, of uterine action. If an accoucheur wishes to perform the operation of turning, and finds the uterus firmly contracted upon the fœtus, he gives a dose of opium to promote relaxation of the uterine fibres; the same practitioner will give the same dose of opium, in a case of hæmorrhage with uterine inertia, having in this case the intention of promoting uterine contraction! Such manifest discrepancies must either be wrong altogether, or the apparent contradiction must admit of being reconciled. In the present state of our knowledge upon this point, no reflecting practitioner can use opium with decision and satisfaction. It is only recently that *Galvanism* has been used in midwifery, but the use of this agent has been purely empirical, and, consequently, of very limited value. It has been used to arrest hæmorrhage, but no one would think, in a case of dangerous flooding, of trusting to this means alone. Numerous other remedies are almost always supplied simultaneously. Hence it happens that unless the just value can be given to each agent, we incur the risk of placing too much or too little reliance upon the means used. We are apt to attribute increased effect to the mere number of our remedies, when it may happen that all are merely repetitions of each other, without any accumulative power. I shall make this appear plainly when I come to speak of uterine hæmorrhage. One of the most singular classes of obstetric medicines are *Emetics,* which are so useful in dilating the os uteri in cases of rigidity, and in contracting the body of the uterus in some kinds of hæmorrhage. This property of inducing contraction of the body of the organ, and dilating its orifice, is often of singular utility. Finally, I may refer to *Bleeding,* which in obstetrics frequently has a different significance from that which it holds in general medicine and surgery. We frequently prescribe venesection purely with reference to nervi-motor action, when there is spasmodic rigidity of the whole of the uterus, or of the os uteri, or when the pains, though otherwise natural, are so rapid and intense, as to make us dread rupture. Thus we bleed to produce comparative inertia, on the one hand, and yet we see that one of the most fatal results of inertia after parturition is loss of blood. I mention these points as seemingly paradoxical, though we may easily reconcile them with each other. I might add, as we shall see hereafter, that there is one form of puerperal convulsion in which bleeding is the only remedy; and another, which is caused by loss of blood alone. In mere practical men, these and similar contradictions are a constant source of difficulty, and it is physiology which alone can render them luminous and clear.

Another field for the practical study of nervi-motor action is afforded by Preternatural Presentations. In the strictly natural presentation, all is arranged so as to provide, as far as possible, for the safety and security of both mother and child. The labour is neither too long nor too short; but in all the preternatural presentations,—I here mean all those which are not presentations of the head,—the motor actions are deranged from their proper order. In head presentations, the latter part of the labour is almost always rapid, and upon this the safety of the fœtus greatly depends. In *Breech and Footling Presentations*, the latter part of the labour is the slowest part of the process, and hence the danger to the child in these presentations. The head is delivered slowly, because the parts are not sufficiently dilated, but still more because the uterus has not been excited to such a state of powerful reflex action and great excitability as that which is induced when the head descends first. In another presentation, and one of the most dangerous which can occur,—I mean *Placenta Prævia*,—much of the peril depends on the circumstance that the os uteri, instead of being excited by the head of the fœtus during the pains, is only pressed upon by the intermediate cushion formed by the placenta. The pains are consequently deficient in motor power, and there is not sufficient mechanical pressure exerted to arrest the hæmorrhage. In another variety of presentation, that of the *Hand*, or the *Arm*, or *Shoulder*, or the *Hand and Head*, the mechanical pressure of the advancing fœtal mass is greater than usual, and the motor actions of the uterus are exaggerated in a corresponding degree; hence one important source of the danger of laceration and rupture in such cases. These dangers are in part mechanical, it is true, but they are still more dependent on excessive uterine contraction. In every other form of malpresentation, the physiological motor action of the uterus is necessarily deranged, being either in excess or deficiency, when compared with the natural standard.

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LECTURE XV.

CAUSES OF EXCESSIVE UTERINE ACTION; OVARIAN IRRITATION; EMOTION; EARLY RUPTURE OF THE MEMBRANES; VOLUNTARY EFFORTS; POSITION OF THE PATIENT; THE FŒTUS; STATE OF THE CIRCULATION; DIGITATION. RULES FOR MANIPULATION IN PRECIPITATE AND IN TARDY LABOURS. SEDATIVES OF EXCESSIVE PARTURIENT ACTION; OVARIAN TREATMENT; BLEEDING; NAUSEANTS; OPIUM; REGULATION OF EMOTION; ABDOMINAL BANDAGE; REST, ETC.

Before entering on the study of the particular accidents of parturition and the puerperal state which arise out of excessive motor action, I wish earnestly to direct your attention to the chief *Causes* upon which such excess depends, and to the means by which we can moderate or remove those unruly efforts of the uterus and its associated organs which become so dangerous in their results.

Ovarian irritation is one important cause of precipitate labour and undue uterine action. The ovaria are the *vis à tergo* of parturition. In some cases, the ovarian stimulus, which in its normal degree produces the proper, physiological excitability of the uterus, on which natural labour depends, is excessive, and induces in the spinal centre and the utero-spinal nerves a state of excitability almost of a tetanic kind. All the motor actions of labour are immoderately increased. The whole surface of the parturient canal becomes intensely excitor, and first the liquor amnii, then the head and trunk of the fœtus, and the manipulations of the accoucheur, produce the most rapid and powerful contractions, so that every uterine pain amounts to a local convulsion. Unless the nervous energy becomes exhausted by the uterine actions of the earlier stages of labour, the excitability increases with the progress of parturition, and reaches its acme at the time of delivery. The physical pain is in proportion to the motor action, being increased by the great pressure exerted on the uterine nerves, and by the sudden and forcible impulsion of the presentation through the passages; in such cases, the morbid uterine motor action, and the injury done to the parturient canal, may be said to partake, the one of the nature of cramp, and the other of violent contusion.

Though the nerves of the ovaria are the primary excitors of the neural energy exhibited in parturition, there are other organs, independent of both uterus and ovaria, which exalt the excitability of the spinal centre and the utero-spinal nerves. Thus a loaded state of the rectum, excitability of the bladder, and certain states of the stomach, act upon the uterus, and produce excessive action of the latter organ. The most important of these sources of excitation is the rectum, which, when loaded, will sometimes derange the whole function of labour, rendering the contractile pains quite uncontrollable. During labour the uterus attracts, as it were, to itself, the reflex effects of local irritation in any part of the body.

Emotion is another cause of precipitate labour. We have more difficulty in defining the limits of this cause than those causes which are physical in their nature. Emotion is truly capricious and Protean in its results in parturition. The same kind of emotional disturbance which in one patient produces the most rapid labour, will, in another, suspend the pains altogether. Sometimes an emotional disturbance will suspend a labour for a considerable time, and then precipitate labour will be caused by some other emotion occurring n the course of the same parturition. Thus I once saw a case in which labour had set in regularly, and bade fair to be concluded within the ordinary period; but it happened that this patient heard of a poor woman, in whom she took an nterest, being in labour, and in extreme danger, at the same time with herself. This intelligence entirely arrested her labour for several days, until, in fact, she heard of the safe delivery of the other party, when her own labour again became active, and terminated very speedily.

Many other causes of precipitancy or excess may occur during the course of labour. One of these is early rupture of the membranes, which acts by bringing the body and head of the fœtus into direct contact with the internal surface of the uterus, and especially with the os and cervix uteri. Another cause of rapid labour, akin to this, is where the quantity of liquor amnii is very small, so that at the commencement of labour, when the uterus begins to contract upon its contents, it at once meets with solid instead of fluid resistance within its cavity.

Improper voluntary efforts are quite enough to complicate a labour seriously. Violent volition appears to influence the uterus somewhat as it does the heart, and it moreover causes the uterus to be squeezed forcibly between the abdominal muscles in front, and the unyielding spinal column behind. Powerful voluntary efforts in the early stages of labour, before the dilatation of the os uteri, and the rupture of the membranes, are always mischievous. In ordinary labour, some amount of voluntary or instinctive action of the muscular system, and particularly of the expiratory muscles, is quite natural during the stages of propulsion and expulsion. In acute or severe labour, these voluntary exertions are productive of great mischief. The efforts of the already excited uterus are assisted by the expiratory efforts, and the uterine actions are increased still more by the mechanical pressure of the abdominal parietes upon the uterus. Hence the serious accidents of this variety of morbid parturition often occur at the moment when patients are making some obvious voluntary effort, either in the height of a pain in the propulsive stage of labour, or while straining at defæcation or micturition.

The position maintained by the patient during her labour has a considerable influence upon the action of the uterus. It is well known that standing or stooping during the pains, or leaning over the back of a chair, or holding to the bedposts, will increase the intensity of the contractile pains. This is evidently because the presenting part is thus brought to bear with increased mechanical force upon the uterus or vagina. The same thing occurs from standing or walking between the pains, particularly after the rupture of the membranes, at whatever stage of the labour this may have occurred.

The fœtus is of course the mechanical excitor of the motor power of the uterus, and the other special motor actions of labour. It may, from its formation, or the way in which it presents, be a more powerful excitor than usual, and thus render the parturient actions excessive. Such, for instance, is the case when the ossification of the fœtal head is unusually mature, so as to exert great mechanical pressure upon the soft parts. The same thing happens when the fœtal head is of the natural size, but where there is deformity of the pelvis, so as to arrest the head either at the brim or outlet. So also, in certain presentations, as the head and arm, or the shoulder, the increased pressure, and the difficulty of impelling the fœtus onwards, will often rouse the uterus, in a reflex manner, to inordinate exertions. The relation of uterine action to the resistance it meets with is often so exact as to give the uterus the appearance of instinctive power. The resistance, whether dependent on the size and position of the fœtus, or the small size or malformation of the pelvis, becomes in effect an excitor of motor action. Hence there are important distinctions between labours which are accompanied by precipitate and excessive action of the uterus, with a capacious pelvic canal, and those in which the same state of the uterus is combined within a small or distorted pelvis.

The accidents, too, of precipitate or excessive labour are different in pelves of different diameter. Thus women in whom the pelvis is below the usual size, are liable to lacerations and contusions, while in those in whom the pelvis is roomy, inversio uteri is more probable, and severe labours in such cases are apt to be followed by prolapsus and procidentia, particularly if bodily exertion be resorted to within a short time after parturition. It sometimes happens, that with violent action of the uterus after the discharge of the liquor amnii, and in the absence of all pelvic impediment, little or no progress is made towards delivery, because the uterus so firmly embraces the fœtus as to reverse its own function, and retains it *in situ*, instead of expelling it. This condition is only to be removed by moderating the violence of the uterus. In cases where excessive action is uncomplicated by mal-presentation, pelvic impediment, rigidity of the os uteri, or other contingencies which may modify its effects, the result is *precipitate labour.* Where such complications occur, the parturient actions may be excessive, but the labour may become lingering and laborious. The exalted condition of the uterus, which if it remained within due bounds would tend to overcome impediments, often renders labour difficult and dangerous by its violence; so that in many cases in which the duration of labour is preternatural, we may have to deal with precisely the same element which meets us in labours which are simply acute or precipitous.

The whole excitor surface, from the fundus uteri to the os externum, may be rendered preternaturally susceptible of stimulus by the ovaria alone, or by the other conditions I have been describing, but the state of the circulation is another distinct cause of parturient excitability. In febrile and inflammatory diseases, particularly the exanthemata, small-pox, rubeola, &c., occurring at the time of parturition, the utero-spinal nerves become remarkably excitable, and labour runs a rapid course. The states of the blood in which albumen and kiestein are eliminated copiously from the kidneys, are also accompanied by marked increase in the excitability of the spinal centre and the utero-spinal nerves.

When labour is proceeding naturally, excessive digitation, whether at the os uteri, in the vagina, or at the os externum, will often convert it into precipitate labour, or labour attended by excessive uterine action. Constant digitation and examination, in labours having a tendency to rapidity, are among the most constant and mischievous vices of a meddlesome midwifery.

But I must remark, more at length, on the practice of frequent examination during labour. "Taking a pain," as it is termed, is necessary to ascertain the state of the parturient canal, particulary the os uteri, and to ascertain the presentation and mechanism of the individual labour. Beyond this, the manipulations frequently resorted to have no precise intention, except it be to satisfy the mind of the patient and her friends, and impress them with the belief that the accoucheur is rendering assistance during the pains—a belief generally without foundation. No principle has been recognised in making examinations, nor any distinction made between the effects of frequent digitation, in cases where laceration or other dangers are impending from excessive action, and others in which peril is incurred from inertia. I believe that in the present practice of midwifery, particularly among young accoucheurs, manipulation is more frequently resorted to in acute than in tardy labours. There is a natural anxiety not to have seemed to fail in rendering assistance in those cases in which the most instant of the accidents of midwifery occur; and hence the fingers are almost constantly within or at the mouth of the vagina. The idea is unfortunately implanted in the minds of lying-in women, that the accoucheur can render them mechanical assistance during each pain, and in accordance with this unfounded expectation, much useless show of doing so is often made.

The application of the principle of nervi-motor action to obstetrics, clearly shows the system of frequent examinations during labour to be wrong in principle, and likely to produce mischief, particularly in acute labours. No one having a clear comprehension of the motor function of the uterus can doubt that all manipulation of the parturient passages, from the introduction of the hand into the uterine cavity, down to the gentlest manipulation at the os externum, or at the os uteri, must increase, in a greater or lesser degree, the muscular contractions which constitute a pain. The effects may not follow nstantly, because of the influence of the ganglionic nerves, which has been already referred to, but the subsequent train of reflex actions are most certainly increased in intensity, however carefully the manipulation is performed. In tranquil abours the examinations may not produce any great increase of excito-motor action, but in acute labours, where the vis nervosa is very abundant, and the contractions of the uterus and expiratory muscles are excessive, frequent examinations must necessarily prove injurious. They may occasion laceration of the vagina or perinæum, rupture of the uterus, or attacks of convulsion from their excitation of the incident nerves concerned in parturition.

With respect, also, to the proper time for taking a pain, a question may be fairly raised respecting the propriety of the common practice, in violent labours. The introduction of the hand during the persistence of a pain, when the nervi-motor organs are in a state of great activity, can answer no other purpose than that of imposing on the mind of the patient, while it is in many cases calculated to do positive injury, as mechanical excitation during a pain calls forth a greater amount of reflex motor action than when it is applied in the remissions. This principle has been recognised and acted upon to a certain extent in some cases by accoucheurs, though it has not been applied to ordinary examinations. For instance, we are always told, in performing the operation of turning, to press the hand onwards in the intervals between the pains, but to keep it perfectly still while the pains continue, lest rupture of the uterus should occur from the increase caused in the expulsive force by the stimulus of the hand. Digitation is the same in principle, whether it be within the uterus or at the perinæum, and it is absurd to have one rule for manipulation in the one case, and a contrary rule in the other.

I believe it may be laid down as a rule, that in well-formed women, when the uterus acts powerfully, when the labour is progressing satisfactorily, and the presentation is found to be strictly natural, no further manipulation should be resorted to, except for the purpose of ascertaining progress, until the head of the child presents externally. This is a point on which delicacy and science alike concur. If frequent examinations are made while the uterus is acting vigorously, it must be at the hazard of complicating the labour, and causing accidents. Besides the mischief accruing from increased action, digitation may weary the uterus by constant action at the time when the os uteri or the external parts are undilated,—a serious waste of uterine power in delicate women,—or it may occasion the too early rupture of the membranes, either by the hand of the operator, or by the energetic reflex actions which its presence in the vagina excites.

Two important rules for practice are clearly deducible from a knowledge of the sources and modes of uterine action.

In the first place, manipulation should be avoided as much as possible in acute labours, where the pains are severe or frequent, and where any additional irritation of the excitor nerves of parturition must increase the reflex action of the uterus in the first and second stages, and of the uterus and the expiratory muscles in subsequent stages. In natural labours, the expiratory actions do not commence until the os uteri is dilated, and the head advanced to the vagina; but if the vagina be greatly irritated by the examinations, they may occur before their proper time. When the examinations are clearly necessary in such cases, the hand or finger should be introduced on the subsidence of one pain, and withdrawn before the appearance of another; or the hand should be kept quiet during the pains, so as to cause as little excitation as possible. Dr. Rigby has already insisted upon this point. It is not meant that cases may not occur in which manipulation will be imperative, notwithstanding an excess of excito-motor action; still the above will be found to hold good as a general rule.

In the second place, where the action of the uterus is weak and inefficient, examinations should be resorted to more frequently, not merely for the sake of ascertaining progress, but for a specific purpose—namely, to increase the reflex, uterine, and expiratory contractions, and thus to accelerate the delivery of the patient. Where the action of the uterus is feeble, the examinations should be made during the continuance of the pains, so as to increase their power.

The term excitation, in its application to spinal pathology, has a peculiar meaning, very different from sensation or irritation. It may be said that sensation belongs to the cerebral, irritation to the vascular, and excitation to the true spinal system. It cannot be too much dwelt upon, that there is no relation whatever between pain and spinal action, whether pathological or physiological. This one idea alone, when it comes to pervade the whole obstetric art, will, I have no doubt, effect a great change in the practice of midwifery. When any considerable augmentation of the vis nervosa occurs in the spinal system, moderate stimulation frequently excites stronger reflex actions than actual violence would do. In the case of the stomach, we see the act of vomiting more readily excited by tickling the fauces with a feather, than by ruder measures. The part which is the excitor of vomiting may even be ulcerated without exciting this act, so likewise will gentle manipulation of the os uteri, under certain circumstances, produce more excessive motor actions than mechanical violence, or even rupture of the organ. This important fact, so capable of salutary application, has never been more than faintly recognised. The stimulability of the spinal system requires special study with reference to these points; but no advance could be made without a knowledge of the principle of reflex spinal action. Wanting this principle, I believe the practice of taking pains, even in the most careful manner, has caused nearly as many accidents as the ruder forms of malpraxis. The uterus has been ruptured by the uterine action excited by taking a pain, and a fatal convulsion has been caused by even the cautious introduction of the hand into the uterus. Denman relates a case of puerperal convulsions, in which gentle attempts at dilating the os uteri during a pain excited or increased the fits. Dr. Ramsbotham has detailed two most interesting cases in which rupture of the uterus occurred while careful examinations were being made at the acme of the pains. The same author also gives an interesting case of convulsion excited by the introduction of the hand into the uterus for the purpose of removing a retained placenta. Cases similar to the latter are to be found in the works of other obstetric writers, and have a most important meaning when viewed by the light which physiology sheds upon the act of parturition.

And now for the reduction of this nervous polarity or excitability, however induced, whether by irritation of the extremities of the ovario-uterine nerves, by irritation of extra-uterine nerves, by the influence of emotion, or by intra-vascular causes. Let us trace the incident nerves, downwards from the nerves of the ovaria to the nerves supplying the outlet of the vagina, examining those sources of irritation which admit of diminution or removal. We cannot forbid the ovaria to exert that wonderful influence upon the uterus which causes it to commence the expulsion of its contents, but we can do much to prevent its becoming dangerons and excessive. There is a form of precipitate and severe menstruation as well as severe and precipitate labour; and it has often been observed that those women who suffer from dysmenorrhœa invariably pass through severe confinements. In dysmenorrhœal cases, therefore, the ovarian periods of pregnancy should be as carefully treated as though dysmenorrhœa were actually present. Rest; the avoidance of physical excitement; laxatives, to keep the rectum free from irritation; with cold hip baths in the intervals between these periods, are the best remedies. Properly managed, the most obstinate dysmenorrhœa, which refuses to yield to treatment in the unimpregnated state, may be cured during the state of comparative rest in which the ovaria continue during pregnancy. The mere occurrence of gestation, without any unusual care, will often effect a cure. At the time of labour itself, quiet of mind and body, warm or opiate enemata, are the best means for soothing the ovarian nerves. Little can be done, however, during labour, compared with what may be effected by way of prevention during pregnancy. It seems not improbable, that by the actions of labour, and the contractions of the uterus and the abdominal muscles, a good deal of pressure is exerted on the ovaria, sufficient to keep up their excitability until the expulsion of the fœtus. This pressure may sometimes be the cause of oophoritis occurring after delivery.

Bleeding is an important means of reducing uterine action. A good deal of doubt is often expressed respecting the efficacy of venesection in acute labours, because bloodletting is frequently followed by rapid temporary contraction of the uterus. But this effect of depletion soon passes away, and leaves the organ less excitable than before. There is, however, in different women, some variability in the influence of bleeding on the excited uterus. The simple effects of depletion in women of strong and full circulation are, I believe, sedative; it lessens the effects of fulness of the cirulation upon the nervous system, and lessens the excitability of the uterus itself, by diminishing the quantity of blood circulating in the organ; but at the time of parturiion, various modifying circumstances may occur. If there should be fainting, the uterus contracts powerfully, if the mind should be disturbed by the operation, there may be owerful contractions depending upon emotion. These causes may sometimes more than counterbalance the immediate ffects of bloodletting. It is in cases of fatal hæmorrhage hat we see the immense influence of loss of blood upon the uterine contractions; here there is complete failure of the nervous and muscular power of the organ. In moderate, or free bloodletting, the effects are of the same kind, but within the limits of safety. In acute labours, in subjects with a weak circulation, bleeding is of course improper, and would fail of its effects. In such cases, the avoidance of excitation must be chiefly relied on.

Nauseating doses of the potassio-tartrate of antimony have a similar effect to bloodletting, though less powerful. Its use should not be pushed to emesis, or it will then excite uterine contraction. Emetic tartar is well adapted for cases which do not bear bloodletting, or to follow moderate venesection. A further use of this medicine is, that by its action on the os and cervix uteri it diminishes the chances of rupture and laceration.

Opium is a remedy generally believed to have a sedative effect upon the uterus when in action. It is prescribed in numerous cases with a distinct view to this effect. We have, however, had no very clear account given of the mode in which it acts upon the spinal system in parturition. I believe the chief influence of opium, in calming uterine action, to be limited to the control of emotion; by removing or diminishing pain and fear, it takes away some important causes of uterine action. But it may indirectly increase uterine action by inducing sleep, which is well known to recruit the uterine motor power. I believe opium generally, by its purely physical and direct effects, increases rather than diminishes uterine action, and that this is the secret of its utility in uterine hæmorrhage. Looking to its physical action alone, it is absurd that we should give opium before turning, to allay uterine contraction, (a constant practice,) and that it should also be given in hæmorrhage to produce contraction, (a practice upon which many obstetricians rely.) Some explanation was necessary to reconcile these apparent contradictions in obstetric therapeutics.

Volition, which, when powerfully exerted in accordance with the instinct of the patient, and in harmony with the reflex actions, is a source of mischief in acute and severe labours, may be made a preservative. To this I have already alluded when treating of the physiology of labour. When we wish to use volition as an auxiliary to sedative measures, we have simply to direct the patient to cry out, or to talk during the pains, after the expiratory actions have commenced. We thus thwart the reflex closure of the glottis, and suspend the series of expiratory efforts, and their direct and indirect action upon the uterus. This is often of essential value in the latter part of the propulsive, and during the whole of the expulsive stages.

The regulation of emotion is also a point of considerable importance in labours attended by excessive action. The patient should be kept in a cheerful frame of mind; her apprehensions soothed or removed as much as possible; and no exciting or distressing intelligence should be communicated during her hour of trouble. The accoucheur who studies the control of the emotions of his patient has an immense advantage over him who conducts a labour merely as a mechanical process. He should arrange and combine both the moral and physical powers of his patient, for her safety in the time of rial: just as the pilot, with a richly-freighted ship under his guidance, in a dangerous passage, studies every cord and fibre of his vessel, estimates their strength and endurance, learns where to direct the strain, where to defend from violence, and cheers and encourages the while, the human hearts who depend upon his skill for safety.

I have seen it recommended, that in precipitate and severe abour the abdominal bandage should be applied firmly round he uterus, with the view of diminishing its excitement. Nothing could be more mischievous than such a proceeding; t would inevitably increase the force and frequency of the uteine contractions by the mechanical pressure of the abdominal muscles on the organ of labour. The use of the abdominal andage should therefore be reserved for cases of moderate terine action or uterine inertia. At the same time, it must e borne in mind that it is in cases where the contents of he uterus are precipitately withdrawn, that pressure, or ather support, is most necessary to the abdomen *after* delivery; but here the bandage should be used, not with any eference to motor action, but on the same principle as after apping in ascites—namely, to lessen the effects of the sudden withdrawal of pressure from the abdominal vessels.

In fine, in all cases of excessive action the patient should e down, and be kept as quiet as possible during the pains;

the rectum should be emptied by an enema early in the course of the labour; digitation should be avoided as much as possible, and only resorted to, to ascertain the presentation, and most cautiously, from time to time, to learn the progress of the labour; in the examinations, especial care should be taken to avoid rupturing the membranes; and if the membranes can be preserved without rupture until the dilatation of the perinæum has been effected, so much the better. No pressure should be made on the perinæum, but the head should be prevented by direct pressure from passing rapidly through the ostium vaginæ. The mind of the patient should be kept as tranquil as possible.

Labour is, as I have already remarked, sometimes so intense as to be almost tetanoid in its character: it would indeed be quite proper to recognise a tetanic variety of parturition. Here the avoidance of all emotional and physical disturbance should be as absolute as in tetanus itself. Between the pains, perfect quiet should be preserved, and during the uterine contractions all unnecessary excitation of every kind should be avoided.

LECTURE XVI.

RUPTURE OF THE UTERUS; CAUSES OF THIS ACCIDENT. EXCESSIVE MOTOR ACTION OF THE UTERUS ITSELF. PREVENTION OF UTERINE RUPTURE. IMPORTANCE OF MODERATING EXCESSIVE UTERINE ACTION. LACERATION OF THE PERINÆUM; CAUSES OF THIS ACCIDENT. OBSERVATIONS ON THE PREVALENT PLAN OF SUPPORTING THE PERINÆUM BY MANUAL PRESSURE.

RUPTURE of the Uterus is perhaps the most appalling of ll obstetric accidents. When rupture has occurred, the utmost that art can do affords but a faint chance of the preservation of life. Any suggestions, therefore, which end to throw light upon its causes, and to point out measures or its prevention, are of great importance. To effect these bjects, the study of reflex obstetrics will, I believe, prove more adequate than anything which has hitherto been proposed.

Rupture of the uterus has been attributed to softening f the uterus during gestation, to deformity of the pelvis, to cutting action of the sharp linea-ilio-pectinea, to excessive ontractions of the uterus, to mechanical violence through wkward or ill-timed attempts to turn the child, and to the mechanical effects of unskilful instrumentation. Other causes f less note have been enumerated, but the foregoing are the most important. I do not think sufficient prominence has een given to uterine motor action, which, in many cases, is he sole cause of the mischief, and which plays an important art in all. To this point, therefore, I shall principally ddress myself in the present lecture.

It is an interesting and remarkable fact that rupture of the uterus seldom happens to primiparous women. It is thus opposed to laceration of the perinæum, which occurs with the greatest frequency in primiparæ. Some practical applications must lie under circumstances apparently so enigmatical. What are the peculiar differences between first and subsequent labours to which we can refer the antithesis which exists between rupture and laceration? It appears to me, as the action of the dilatation of the perinæum is almost purely mechanical, it is quite natural that its distention in first labours should be the most dangerous, while in subsequent deliveries its distention or dilatation should be comparatively easy. On the contrary, the actions of the uterus, both of dilatation and contraction, are chiefly nervi-motor, and it is equally natural that the nervi-motor actions should become more perfect and forcible with each succeeding labour. This is the case with the reflex uterine actions, and not only so, but the voluntary efforts of parturient women are more considerable in multiparous than in primiparous women. Believing rupture of the uterus to depend on the contractions of the uterus itself in the great majority of instances, I see in these circumstances a sufficient explanation of perinæal laceration in first labours, and of rupture of the uterus in those which occur subsequently to the first. What I contend for is this, that the uterus is not generally burst open by the advancing fœtus, or crushed between the fœtal head and the bony pelvis, whether natural or morbid; but that it tears and rends itself by its own contractions.

A strong proof of the importance of uterine contraction in causing rupture is yielded by the fact, that sometimes the peritonæal coat of the organ is torn in situations and shapes in which no mechanical pressure could have acted. In some cases, the peritonæal aspect of the uterus only is ruptured, and the patient dies from hæmorrhage into the peritonæum, if any of the large uterine vessels are torn. Rupture may also occur, during pregnancy, either from disease of the uterus, or from external injury, or violent contractions of the abdominal muscles, or contractions of the uterus. It is generally said, in the latter case, to be caused by the movements of the child; but I have already given you my reasons for attributing the supposed fœtal movements to the uterus. Of course, in pregnancy, there can be no suspicion of pelvic pressure or distention by the fœtal head. The accident is more common too in labours with male than female children. This appears to depend on the large size of the head, and the consequent increased action of the uterus excited by the head, and which is necessary to impel it through the pelvis.

In some points of view we may compare rupture of the uterus with rupture of the heart. It is remarkable that rupture of the left ventricle should be more frequent than rupture of the right side of the heart. We now know that the nerves of the left side of the heart are larger than those of the right, and the greater muscularity of the left ventricle I need not remark upon. These facts account for the frequency of rupture on the left side of the organ, the heart, like the uterus, being torn by the violence of its own contractions. If rupture of the heart depended on any other general cause than this, rupture of the right ventricle, as the weakest part of the organ, must be most common; and it is a significant fact, that in those rarer cases of rupture of the heart caused by external injury, it is the right ventricle which is first and most frequently injured. Among the more important causes of rupture of the heart are violent and long-continued actions, excited by excessive emotional disturbance and violent physical exertion. Is it not probable, also, that violent and prolonged muscular action, whether of the heart or of the uterus, favours rupture by softening the muscular structure, becoming thus a predisposing, as well as an actual, cause of laceration? It is well known that in hunted animals the muscles are found preternaturally soft. The prolonged efforts of the uterus, in some cases of laborious labour, probably first induce softening, and then laceration. It is only by observing all the facts of uterine rupture, and pursuing it through its peculiarities and analogies, that we can acquire a preventive knowledge of this fatal accident.

Many cases of rupture occur when the irritation exerted in the parturient passage, and the uterine reflex action brought to bear against them, is, from some obvious cause, greater than usual. When, for instance, the hand and arm present, or when the head is above the natural size.

Or the accident may take place at a moment when some extra amount of volition, emotion, or extra-uterine reflex action is brought to bear upon the uterus. As, for instance, when the patient is making voluntary efforts to evacuate the rectum and bladder, or when the uterus is contracting forcibly from mental emotion, or during the powerful extra-uterine reflex actions of vomiting. The situation of this accident is most frequently at the os and cervix uteri.

In rare cases the whole of the os uteri is separated from the rest of the uterus, and remains in the vagina, in the shape of a ring. No mere mechanical pressure could effect this; at least, it seems to me impossible to believe that the pressure of the head of the child in a contracted pelvis cuts through the uterine neck. I prefer to consider it the result of muscular action of the body and fundus, combined with rigidity of the os uteri; the internal mechanical pressure of the fœtus, and the external pressure of the pelvis being adjuncts rather than principals, in causing the accident.

It is well known that the uterus is sometimes ruptured by the violence of its own contractions when there is no fœtus within its cavity. Denman relates an interesting case from the presence of a polypus in utero. Several years ago, I witnessed a case in which it occurred from a collection of hydatids. In these cases uterine pains similar to those of labour are excited in such force as to tear the structure of the uterus. They offer an additional proof that this accident depends more on muscular contraction than upon mechanical injury.

Undoubtedly, cases of rupture do occur which are dependent upon softening of the uterus from inflammatory action, either during or before labour, or upon malignant disease of the uterus; but such cases are rare when compared with rupture of the uterus from self-contraction; and while we cannot often prevent softening, we *can* do much to prevent excessive uterine and extra-uterine action of every kind. There are also cases of rupture depending upon external mechanical violence, but these are generally the result of accidents beyond our control.

Rupture may occur under very different conditions of the uterus, as regards its motor actions. It may happen before parturition has actually commenced, when the only contractions present are those wandering motions of the organ which have been hitherto mistaken for the movements of the fœtus; it may take place in the early part of labour, when the os uteri has not as yet dilated, and when the contracted state of this part of the uterus is in direct antagonism with the actions of the body and fundus; or, lastly, it may occur after the full dilatation of the os uteri, when the fœtus has fully engaged the parturient canal, and consequently, when the os uteri has passed from a contractile to a dilatile condition, and is acting powerfully upon the fœtus, in harmony with the rest of the organ. The immediate cause of rupture may either be some act of volition, or of emotion, or it may be a reflex action, or a simple peristaltic action. Examples of each of these forms of rupture can readily be selected from collections of cases.

Many high authorities have recommended that in all cases in which there are premonitory signs of laceration, delivery should be effected by artificial means. An idea that the uterus will remain quiescent under the mechanical excitation necessary to extract the child, seems to me but too evident in this advice. Dr. Burns says, "When the pelvis is contracted, and there is any symptom indicating the risk of laceration taking place, the forceps are instantly to be employed, for when such symptoms exist in any case when the forceps are applicable, it would be criminal to delay." Another high authority, Dr. F. Ramsbotham, observes, "It would be more desirable, indeed, if some precursors of this dreadful occurrence were discovered, that delivery might be effected before the laceration happened, and thus the peril be averted." And again the same obstetrician remarks, "If by any symptoms we could be previously convinced that the accident would happen, it might always be prevented by timely delivery." In framing this principle of treatment, I do not think the motor cause of rupture has been sufficiently borne in mind, or that the effects of manipulation and instrumentation in increasing the motor actions of parturition have been properly estimated. Yet these excellent authors, as well as many other writers on obstetrics, have described cases in which the uterus has been ruptured, evidently by the use of instruments, or by manual interference. The study of motor action enables us to detect at once the fallacy involved in the recommendation of that which frequently proves the *cause* of rupture, as the best mode by which to *avert* it.

As I insisted in the last lecture, during the excitable condition of the utero-spinal nerves present in parturition, no manipulation or instrumentation can take place, either within or at the entrance of the vagina, which does not, besides its own mechanical effect, excite reflex motor action of the uterus. The reflex action may not occur instantaneously on the application of the excitation, which may be made in the intervals between the pains; but when the pains arrive, the irritation is necessarily felt in an increase of the contractile actions. This fact alone should make us chary of applying any new stimulus to the already over excited uterus.

In some of the most candid accounts of the immediate circumstances attending laceration, it is seen that the rent occurred at the very time when manipulation was going on, and when the lacerating force was being increased by the obstetric attendant. If a minute account were generally published, it is probable that this would appear to be the truth in a greater number of instances. In a case recorded by the eminent accoucheur I have already quoted, (Dr. Ramsbotham,) the narration is as follows:—"I attended an unmarried woman, pregnant with her first child, who was in as comfortable circumstances as her situation would admit of. When labour set in, the os uteri opened with no difficulty, and the child was born in four or five hours from the time I was summoned. She again became pregnant, but it was under different circumstances, and her mind was much more disturbed than on the first occasion. On the accession of labour, the membranes broke early, the pains soon became exceedingly violent, the head was urged powerfully against the undilated and rigid os uteri, irregular muscular spasms supervened, and at the end of about five hours from the rupture of the membranes, when the dilatation did not exceed the diameter of a shilling, *while I was instituting an examination in the acme of a strong pain,* with the greatest possible care, I felt the os uteri split on the right side, and I traced the rent considerably upwards through the cervix. At the same moment, the head passed into the vagina, and was expelled by the continuance of the same contraction. During the progress of this labour, I bled the patient to syncope three different times, and exhibited opium freely, my mind being impressed with a dread of the very accident which occurred. It is an instructive case, because it proves, that although an os uteri has relaxed and dilated readily in a first labour, it may on after occasions possess a high degree of unnatural rigidity, and that, too, independently of any discoverable disease in the organ itself. It proves, also, that the much-vaunted power both of bleeding and opium will not always avail in removing rigidity. The poor creature died, on the fourth day after delivery, of uterine inflammation."

I would sincerely desire to avoid reflecting on the treatment pursued in this case, but I conscientiously believe that a knowledge of the principles of reflex action would prevent manual examination, as the rule, at the height of a strong pain in a case of rigidity of the os uteri, in which, as in this, the rupture of the uterus was dreaded. I say this, however, with a full recognition of the impossibility of preventing the accident in some cases by the most judicious management.

In a second case related by Dr. Ramsbotham, the particulars are somewhat similar. It occurred in a patient suffering from anasarca. "The os uteri, from the beginning of labour, bore a thick, soft, puffy, œdematous character; its dilatation proceeded slowly and painfully; the membranes broke at one in the morning, when it was dilated to the size of a crown; at four, its diameter was little more; *and while I was in the act of examining, during a strong pain*, as in the last-mentioned case, I felt the uterus tear at the back part, in a direction upwards."

The true preventive treatment in anticipated rupture of the uterus, lies in the reduction of the excitability of the utero-spinal nerves and their spinal centre, and in the avoidance of all excitor causes of every kind whatsoever, which are not inevitable to the particular labour. In fact, the treatment must be essentially the treatment of excessive parturient action, both uterine and extra-uterine, due regard being had to the particular accident which threatens. When instruments are used, operations performed, or medicines administered, in such cases, one question should ever be before the mind of the obstetrician,—Will the mechanical, or other expeeted advantage compensate, or more than compensate, for the nervi-motor action certain to be excited by interference? This question must be solved in every case, before the preventive treatment of this accident can be placed on its right basis. One thing is perfectly clear to my mind—we ought, in labours accompanied by excessive uterine action, no more to use unnecessary irritation of the os uteri, than we should use irritation of the rima glottidis in asthma or croup; of the fauces in excessive vomiting; or of the sphincter ani in the tenesmus of dysentery. The questions of the reduction of inflammation, of removing obstructions, and of affording mechanical aid, are all highly important in themselves, but they are undoubtedly subsidiary to the nervi-motor condition of the parturient organs.

Laceration of the Perinæum is by no means an uncommon accident in midwifery. As I have already remarked, it is more frequent in primiparæ than in subsequent births, while rupture of the uterus is almost confined to post-primal labours. It generally occurs during the pain by which the head or the trunk is expelled through the os externum, and in most cases it begins at the vaginal margin of the perinæum, extending towards the anus, and sometimes throwing the two cavities into one. Occasionally it happens that the rend takes place in the middle of the perinæum, the injury being so extensive as to admit of the passage of the child, while the anterior edge of the perinæum remains perfect. My able colleague, Dr. Robert Barnes, has made the interesting observation, that a slight laceration of the anterior part of the vagina, similar to that which so often occurs to a small extent in the posterior raphé, is very common in first labours.

It is generally admitted that laceration of the perinæum occurs from the head of the child passing through the vagina so rapidly, that the perinæum has not sufficient time to dilate; the accident rarely happens where the labour is tedious or protracted. Now, if it can be shown that the support of the perinæum, which, in other words, means pressure applied to the perinæum, and to the posterior part of the vagina, does, by exciting reflex action, increase the energy of the pains, it would at once be granted, that such a practice must necessarily increase, instead of diminish, the danger of laceration, unless the mechanical pressure preserved the perinæum in some other way, so as to more than compensate for the increased action of the expelling powers.

Denman, one of the most candid of all writers on midwifery, seems to have had a vague suspicion of the inefficiency of the common plan, though, like most other authorities, he laid great stress upon the necessity of pursuing it. Speaking of parturition in the lower animals, he says, "Though no means are used to prevent the laceration of the perinæum in quadrupeds at the time of parturition, it is remarkable that they are rarely or never liable to it, except in those cases in which the necessity of their situation is supposed to require assistance. . . . . It is therefore reasonable to suppose that the frequent occurrence of this laceration in the human species, allowing that it is in some cases and in some degree unavoidable, ought to be imputed to some accidental cause, or to error in conduct, rather than to any peculiarity in the construction of the part, or in the circumstances of their parturition, because, when women are delivered without assistance, I have not in any case observed any very considerable laceration." In another part of his work he repeats, that "none of the classes of animals are ever liable to a laceration of the perinæum, except when extraordinary assistance is given in cases of otherwise insuperable difficulty, and it is well known that the laceration in any important degree does not universally, or perhaps generally, happen to those women who are delivered before proper assistance can be given." On another occasion he admits that one of the most desperate cases of laceration which ever occurred in his practice, was in a lady with whom he had been most assiduous (on the ordinary principle of supporting the perinæum) in his endeavours to prevent it.

Dr. Collins considers that frequent examinations in slow labours excite inflammation, and that they are "a very frequent cause of lacerations of the perinæum, as in proportion to the amount of inflammation in this part, the more reluctantly will it be found to yield to the passage of the head, and the more likely is laceration to be the consequence." Dr. Fleetwood Churchill is still more decided: "I really believe that it would be better not to touch the perinæum at all, than to make injudicious pressure. It has been my lot to witness more than one case where rupture was owing to excessive and injudicious support." In continental practice, laceration is very common, and continental accoucheurs not only support the perinæum, but apply various unctuous substances, and dilate the vagina, by introducing the closed fingers, and then opening them so as to stretch the parts in the intervals of the pains. Thus it is evident that laceration may occur when the greatest attention is paid to the management of the perinæum on the recognised plan, and that some authorities consider this great anxiety about it, together with the manual interference it gives rise to, as one cause of laceration. Those, however, who have held this opinion, have thought chiefly of the inflammatory state of the parts which digitation produces. Little or nothing has been said about the increased motor action which such irritation excites.

Now to the question — Does irritation of the perinæum excite reflex actions of the uterus and the respiratory muscles? All the egestive canals are under the control of the spinal marrow, and there is certainly no other instance in which irritation of any part of the canal does not excite the expulsive act. The excitor power, too, is generally most abundant about the external orifices. We see this in the sneezing produced by irritation of the nostrils, the vomiting from tickling the fauces, the cough from irritation of the larynx, and in many other cases. In the same way that the os uteri is the most powerful excitor of uterine action, so I believe the os externum to be the part of the vagina most strongly excitor of the expiratory muscles. At other parts of the labour, the child often remains stationary; but when once the pressure of the head is brought to bear on the edge of the perinæum, it is speedily followed by the most forcible pains which occur in the whole course of labour, and which do not cease until the patient is either delivered or exhausted. I have frequently observed that the moderate pressure recommended as a guard to the perinæum, in which this strongly excitor surface is irritated on the one side by the advancing head, and on the other by the hand of the accoucheur, exerts a sensible influence upon the pains, increasing both their frequency and force; and I have obtained the same admission from many experienced accoucheurs. I know of many gentlemen largely engaged in midwifery practice, who, without attempting to account for it on principles similar to those I have advanced, are so convinced from experience of the mischief of supporting the perinæum, that they entirely avoid it. This view of perinæal irritation was one of the first things which occurred to me when I began to investigate the function of parturition and its diseases by the aid of reflex physiology.

The consequences of the accident, when it occurs to such an extent as to preclude the adhesion of the fissure by surgical means, are truly deplorable. The subjects of it are entirely unfitted for the conjugal state, and in many cases there is no power of retaining the fæces. I have seen instances where the unfortunate sufferers were compelled to sit throughout the day on a bed-chair, and to sleep at night on a prepared mattrass, because of the injury to the sphincter ani. Happily, at the present time, autoplastic surgery promises to do much for the relief of such miserable suffering. Still, extensive laceration must always be a very serious matter.

The prevention of this accident is always an object of solicitude to the accoucheur, even in the most perfectly natural labours. The chief rule laid down by the great majority of obstetric writers is the support of the perinæum by the hand during the passage of the head and trunk. This we are directed to do with the most unremitting perseverance when there is any apprehension of rupture. The late Dr. Hamilton stated that he had supported the perinæum for nine hours together, without intermission! This mode of prevention is generally considered as almost infallible; and when laceration of the perinæum takes place in spite of it, the young practitioner generally blames himself for not having been sufficiently assiduous in its protection. Pressure on the part liable to the accident—simple mechanical pressure—is the chief thing recommended when the labour is acute, or the perinæum unyielding, soothing fomentations, the evacuation of the rectum, the application of soothing ointments &c., being applied as accessories. Now, I confess I do not know a more absurd situation than that of an accoucheur, loomed to squeeze the sphincter ani for hours together. Not that I would for one moment ridicule any practice which could be useful, for utility is before and above all in the practice of our art; but I believe this plan to be well nigh as useless as it is absurd—in fact, it seems a true reliquum of the midwife, and it would be no small boon to obstetrics to relieve it from such a barbarism altogether.

Even if there were no such principle as reflex motor action, and no danger whatever of exciting inflammation, it may be fairly questioned whether the long continued pressure of the hand acting in a merely mechanical manner, is so adequate to support the perinæum as is generally supposed. Pressure on the mouth of a distensible tube through which a large solid body is passing, can have little effect in preventing laceration, unless it does this by preventing the advance of the distending body. It is not a little singular, that pressure exerted on the os uteri by the head of the child within, and the rim of the pelvis without, should be considered a common cause of rupture of the uterus, while the pressure of the perinæum between the hand of the attendant and the head of the child, should be deemed a means of preserving this part from laceration! There is no such great difference between the structure of the two parts, and the circumstances in which they are placed, as to warrant the opposite conclusions so generally arrived at.

The knowledge of the principle of reflex motor action would teach us that in acute labours, in which laceration chiefly occurs, where the pains are excited in sufficient or excessive force by the fœtus, all external sources of motor action should be avoided. On the other hand, in cases where there is no danger of accident, when the pains are weak or deficient, external means of exciting parturient action may be resorted to beneficially. It follows, from all I have said, that if there be any truth whatever in the existence of excited motor actions in labour, from irritation of the parturient canal, pressure on the perinæum and posterior part of the vagina is resorted to in those cases where there is a possibility of its being mischievous, and avoided when it might prove serviceable.

Still there is one way in which I believe the support of the perinæum by the hand may be of service, and which indicates distinctly the proper mode of managing cases in which the danger of laceration exists. This is by mechanically retarding the advance of the head. If by exerting pressure we excite uterine action, and at the same time prevent its effects by retarding the head, we do wrong and right at the same time, and the right may more than counterbalance the wrong; but if we practise the right alone, the gain will be far greater. This we may do simply by moderate pressure on the head of the child. I apply this pressure by the tips of the fingers and the thumb of the right hand, arranged so as to press in an annular form upon the presenting part. By acting thus we do no injury to the child; we retard the advance, but we excite no unnecessary and unnatural motor action. The only circumstances in which I would recommend perinæal pressure are in those cases in which the perinæum is largely developed in its posterior portion, and where the head of the child, instead of advancing under the pubic arch, is urged very forcibly against the posterior portion of the perinæum, the anterior being little dilated. In some cases of this kind, support is advisable, the motor action excited being of less consequence than the retardation of the head, which is advancing in an improper direction.

But besides the immediate management of the perinæum, much may be done in the way of precaution during the progress of labour. Where there is the apprehension of this accident, the indication throughout is to moderate the motor action, so as to give time for the gradual dilatation of the os externum. To fulfil this, the examinations should be as seldom as may be consistent with proper attention to other points, such as ascertaining the presentation, and making those changes n the position of the presenting part which may be required. Great care should be taken to preserve the membranes entire until the os uteri is fully dilated; it is even beneficial if they hould remain unbroken so as to act with fluid pressure on he perinæum. Besides attention to these points, the rectum, he bladder, and the stomach, should be kept from irritation, lest these organs should become excitors of unnecessary partuient action. Volition and emotion require to be cautiously egulated; as both voluntary emotional motor efforts frequently roduce laceration. The best mode of preventing this is to ncourage the patient to cry out, the open state of the glottis taking off the pressure, and rendering voluntary and emotional efforts alike impossible. Emotional motor action may often be thus neutralized by exciting a voluntary cry; but sometimes emotion is so powerful as to defy this control; the woman, in a state of desperation almost amounting to rage, makes the most tremendous efforts at expulsion: in such cases, Denman states that he has obtained a respite by suddenly telling her that the child was actually born!

LECTURE XVII.

IGIDITY OF THE OS UTERI; DIFFERENT FORMS OF RIGIDITY; TREATMENT. ENCYSTED PLACENTA; NATURE AND TREATMENT OF THIS AFFECTION. HOUR-GLASS CONTRACTION; SEATS OF CONTRACTION; ITS CAUSES AND TREATMENT. INVERSION OF THE UTERUS; MECHANICAL AND MOTOR THEORIES; DESCRIPTION OF THIS ACCIDENT; RE-POSITION OF THE UTERUS. AFTER-PAINS; THEIR CAUSES AND TREATMENT.

RIGIDITY OF THE OS UTERI.

N a former lecture of the present course, when giving the hysiology of the dilatation of the os uteri, I described the ontractile and the non-contractile tissues of which this part f the organ is composed. I endeavoured, at the same time, to how that the opening of the os uteri during parturition depends, part, upon the mechanical distention of the non-contractile issue, and partly upon the muscular dilatation of the contrac- ile fibres which enter into the composition of the os and ervix uteri. Rigidity of the os uteri in labour may consist ither in the absence of distensibility or of dilatability, r in both of these states combined. The rigidity may be perfect, he os uteri remaining quite undilated, or it may dilate to a ertain extent, and then refuse to yield farther.

During the premonitory and the succeeding stage of labour, articularly with a first child, and still more when a first labour ccurs late in life, the distensile element is frequently hard nd unyielding. In multiparæ also, when contusion or injury as occurred in former labours, or when the os and cervix ave been the seat of disease in the unimpregnated state, this orm of rigidity is very common. It also occurs in cases in which the os uteri is heated, irritable, or inflamed, and where it is consequently not lubricated by the customary secretion. This form of rigidity is precisely similar to rigidity of the perinæum.

The other form of rigidity occurs in cases where the causes of acute labour or of excessive uterine action are in operation. Instead of the kindly physiological dilatation of the os uteri during the contractions of the body and fundus, the os uteri contracts with the rest of the organ, thus reversing its proper function. The contraction continues also, or the part remains rigid, in the intervals between the pains. Any irritation of the os uteri, whether by the head of the fœtus when brought to bear against it during a pain, or by the finger of the accoucheur, causes it to contract still more firmly. It is in this form of sphincteric rigidity that rupture of the uterus is to be especially dreaded.

In numerous cases, both the muscular and mechanical forms of rigidity exist, and mechanical rigidity is itself sometimes a cause of spasmodic closure of the os uteri. The heat and irritability of the os uteri render it morbidly excitable, and the pressure of the liquor amnii, or the presentation, instead of exciting a reflex dilatation of the mouth of the uterus, excites it to spasmodic contraction. As I have before observed, this state may be considered as a tenesmus uteri, and it is analogous to the tenesmus affecting the bladder and rectum, in certain of their disordered conditions.

The treatment of rigidity of the os uteri must have reference to its twofold nature, and must be modified according as the rigidity is chiefly mechanical or sphincteric in its nature.

Time and patience, waiting for the result of the uterine actions, and avoiding all uterine excitation, are generally sufficient to overcome the ordinary cases of rigidity, especially if the liquor amnii has not been evacuated. At every pain there is a physiological attempt to dilate the os uteri, and this at length succeeds in most cases, except in those in which the os uteri is diseased.

In plethoric cases, bleeding is often of great use; it tends powerfully to lessen the mechanical rigidity, and to promote the yielding of the sphincteric contraction. Bleeding from the arm is generally practised, but I have no doubt that in some cases not admitting of general depletion, and irreducible by other means, the application of leeches to the os uteri would prove of great service. Leeches are now so frequently applied through the speculum to the os uteri, for disorder of the unmpregnated uterus, that there could be no objection to their use during parturition. Nauseating doses of antimony, or ipecacuanha, are important remedies in rigidity of the os uteri; they act, in the first place, by diminishing the mechanical rigidity, on the same principle as they act in strangulated hernia; and in the next, they promote the muscular dilatation of the uterine mouth, by producing nausea, and thus bringing the reflex relation between the uterus and the stomach into play. The reflex relation which exists between the cardia and the os uteri, which I have so often referred to, is most valuable as a therapeutic agent. Warm enemata are also useful in rigidity; they act upon the uterus as a local fomentation, and they excite another salutary reflex action—namely, that which exists between the sphincter ani and the os uteri. The dilatation of the sphincter ani, and even of the sphincter vesicæ, exerts a sensible influence upon the os uteri, when its closure is simply or chiefly sphincteric. A warm bath, or a hip bath, or warm fomentations, tend to relax both contractile and mechanical rigidity. In those cases of closure of the uterus, arising from insuperable rigidity of the non-contractile tissue, the ultimate remedy is incision of the os uteri, at the most rigid portion of the ring it presents. In cases in which rigidity is irreducible by ordinary means, and consists of sphincteric or spasmodic contraction, the os uteri may be sometimes dilated mechanically by the fingers, or if this should be mpossible, or if danger should be apprehended, incision into the os uteri is necessary here also. But in all kinds of manipulation at the os uteri, the utmost caution ought to be observed, lest rupture of the uterus, or convulsions, should be excited by the means taken to avoid a lesser difficulty.

ENCYSTED PLACENTA.

This is an uncouth name sometimes given to cases in which the sphincteric contraction of the os uteri comes on rapidly after parturition, before the placenta has been expelled.

The placenta, in these cases, may be either attached to the uterus, or it may have been thrown off, and be lying close within the contracted os uteri. This complication is most common after acute labours, or in prolonged labours, where the pains have been excessive, up to the time of delivery Excepting that it occurs after delivery, instead of in the early stage of parturition, it is comparable to that form o rigidity in which sphincteric contraction of the os uteri is predominant. Owing to the increased mobility which the os uteri acquires during the progress of labour, the post-partum contractions are more forcible than any active contraction which occurs before delivery; and the rigidity is never mechanical, because of the great dilatation which has occurred during the progress of the labour.

In treatment, it is of considerable importance to deal promptly with these cases. The longer the os uteri remains contracted, the more difficult will its dilatation, so as to admi of the extraction of the placenta, become. If the placenta can be felt close to the os uteri, gentle but firm traction of the cord, held as near as possible to its root in the placenta should be used, so as to convert the placental mass into a dilator. If this plan should not be successful, the os uter must be slowly dilated by the fingers, so as to admit the hand or fingers, according as the placenta may be required to be detached from the uterus, or merely withdrawn fro the cavity. The utmost gentleness consistent with the necessary force should be employed; and if necessary, any threatening of convulsion or laceration should be prepared for by bloodletting. If the patient's mind should be excitable, or the dilatation of the os uteri should be painful, an opiate is of great use; but it acts rather by soothing mental emotion and allaying pain, than by reducing the spasm of the os uteri. We can often beneficially assist the effects of traction of the umbilical cord in dilating the os uteri, by gentle pressure exerted externally upon the abdominal surface at each recurrence of the uterine contractions; sweeping the placenta as it were into the pelvis and towards the os uteri, by the hand, while steady traction of the cord is being kept up.

The foregoing remarks apply to cases in which the placenta is either wholly adherent to the uterus, or the uterus at large is so firmly contracted upon the separated placenta as to prevent internal uterine hæmorrhage. Cases, however, occur, in which spasmodic closure of the os uteri is attended with separation of the retained placenta, and inertia of the body and fundus. In such cases, dangerous internal hæmorrhage is inevitable, and the removal of the contraction of the os uteri becomes quite secondary in importance to the arrest of the hæmorrhage. Our first object here must be to excite such an amount of uterine contraction as to stay the loss of blood. In all cases where the first steps taken for the dilatation of the os uteri, which of themselves tend to produce uterine contraction, are ineffectual, the uterine inertia should be treated most energetically *per se*, without any reference to the state of the os uteri.

HOUR-GLASS CONTRACTION.

In some cases of retained placenta the uterine spasm is not situated at the os uteri, but at the junction of the cervix uteri with the body of the organ; in the same situation, in fact, as the narrow portion of the organ in the unimpregnated state, and at which the greatest resistance is met with in the introduction of the uterine sound. In other cases the constriction is still higher up, involving the body of the uterus, being similar in its nature to those band-like spasmodic contractions, which are sometimes observed in the large intestine. In the lower animals, where the uterus in its anatomy resemble an intestine, there can be no difficulty in understanding this form of annular contraction.

In other cases, the hour-glass contraction occurs after the separation of the placenta, when it may be the cause of internal hæmorrhage, because of the inertia of that portion of the uterus which is above the stricture. After the expulsion of the fœtus, the contractions of the uterus ought to be uniform in the entire organ, so that in hour-glass contraction there is always a double departure from the physiological condition of the uterus; there is both spasm and inertia. The treatment of these cases must be conducted on the same principles as cases of sphincteric contraction of the os uteri; but we have an additional remedy, of considerable efficiency, in frictions applied to the abdomen over the uterus. True and complete hour-glass contraction is a rare affection; but in very many cases of post-partum hæmorrhage, portions of the uterus are spasmodically contracted, while others are so relaxed as to admit of the flow of blood from the mouths of the vessels on its internal surface. Occasionally it happens that one lateral half of the uterus will be contracted while the other half is relaxed. In cases of hæmorrhage, with hour-glass contraction, there may be no escape of blood per vaginam, the effused fluid being confined in the upper chamber of the uterus by the stricture.

The causes of the hour-glass contraction may be any of the causes of acute, irregular, or tardy labour; but it most generally occurs after rapid parturition, particularly the rapid transit of the child through the external parts. Coagula in the uterus, the retained placenta, or improper traction of the cord, and mental emotion, are all exciting causes of the accident.

INVERSION OF THE UTERUS.

This accident has sometimes been attributed to inverted action of the uterus, but more generally to mechanical traction of the cord, and to injudicious attempts at removing the retained or adherent placenta. When inversion is referred to traction of the umbilical cord, whether in consequence of a short funis, the sudden birth of the fœtus while the mother is in the upright position, or the attempts of the obstetrician to remove the placenta, it is always believed to depend on the merely mechanical force which is in operation. It is considered that the fundus uteri is dragged down mechanically through the os uteri and vagina, the uterus being supposed to be passive during the occurrence of the inversion.

From the best consideration I have been able to give the facts of inversion, I am persuaded that it depends in *all* cases mainly upon an *active* condition of the uterus. Where it takes place without any mechanical interference, there can be no doubt of the preternatural and perverted activity of the uterus. But I am convinced, that even in cases where the placenta is attached to the centre of the fundus, and when the cord is drawn through the vagina with any amount of force likely to be exerted by an accoucheur, it is not a mere mechanical displacement which produces the accident, but the irritation of the fundus uteri, by traction, excites contraction of the fundus, thus producing that contraction and descent of the fundus uteri, which is the first stage of the accident. The common opinion has very naturally arisen, from observing, in some cases, that the fundus uteri, when the placenta is firmly attached, follows the advancing cord, while traction is being used. According to my view, the depression of the fundus uteri, even in these cases, is not a simple yielding of the part, according to mechanical principles, but an active contraction, excited by the irritation of the fundus uteri by the traction of the placenta.

To pursue the steps by which complete inversion is produced. There is, first, cup-like depression of the fundus uteri; coincident with, or immediately following upon, this depression, there is hour-glass contraction of the body or lower portion of the uterus. The annular contraction of the body of the uterus grasps the introcedent fundus as it would a foreign body, and carries it downward, for expulsion through the os uteri, the os uteri being at this time either in a state of inertia, or actively dilated, just as at the end of the second stage of labour. After the inverted uterus has passed through the dilated os uteri, this part of the organ becomes contracted, preventing reversion from taking place. Thus, there is, first, depression of the fundus uteri, with annular or hour-glass contraction of the body of the uterus, and dilatation of the os uteri. Next, there is intus-susception of the fundus by the body of the uterus. Lastly, complete inversion occurs, with contraction of the os uteri upon the inverted organ. If we wished to describe this accident in three words, they would be, —introcession—intus-susception—inversion. The displacement nay not be complete; it may in some cases stop at introcession; n others, at intus-susception, and then return to the natural tate; or it may remain intus-suscepted. Inversion produces iolent disturbance of the nervous system, and is frequently ttended by alarming hæmorrhage. But the symptoms of the ntus-suscepted uterus are still more violent. The stranguation of the fundus is almost as severe a shock to the ystem as actual rupture. In inversion, the hæmorrhage is omewhat arrested by the os uteri acting as a tourniquet

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to the uterus. We may compare perfect inversion of the uterus to intus-susception of the intestinal canal, only that the intus-suscepted portion of intestine is not protruded externally. Probably, many cases of prolapsus ani should be called inversion of the rectum, rather than prolapsus.

Inversion generally occurs quickly after the delivery of the fœtus, between the expulsion of the child and the expulsion of the placenta. I have known it to take place after the death of the mother, and after rupture of the uterus had occurred. In the latter case, the fœtus was passed into the peritonæal cavity, while the uterus became inverted, and protruded through the vagina. The predisposing causes of the accident are the causes of acute labour and excessive or irregular action of the uterus. It is of very great importance to understand clearly the real nature of inversion, as it is one of those accidents which is most confidently referred to malpractice. The less it is considered a mechanical displacement the less disposition will there be to attribute its occurrence to the accoucheur; owing to the prevalence of the mechanical idea, obstetricians have sometimes been blamed most unjustly in cases of inversion.

The treatment consists of the mechanical re-position of the uterus. Immediate steps should be taken to reduce the inversion, because of the rapidly increasing contraction of the os uteri, which, by impeding the circulation, causes an increase in the size of the tumour. The size of the uterus should be reduced as far as possible by pressure, and by detaching the placenta in cases where it still adheres. By moderate but sustained force the uterus is then to be passed up through the vagina and os uteri. After the organ has been partly passed through the os uteri, the muscular action of the uterus itself assists in restoring it to the proper position. It is reinstated with a sudden jerk, causing a considerable report at the moment of its restoration. In cases where intus-susception exists, the hand must be passed through the os uteri, so as to overcome the annular contraction, and to restore the intus-suscepted portion to its proper position. Cases of intus-susception and inversion require careful watching until the uterus has permanently contracted.

AFTER-PAINS.

A certain amount of periodic uterine contraction after labour, attended with some degree of pain, is strictly physiological, the object to be effected being the safe and permanent contraction of the uterus. When these pains are excessive or long continued, they become pathological, and are then proper objects of treatment. Some accoucheurs, believing them to be always beneficial in their results, are very jealous of any attempts to moderate their force or duration; but there can be no doubt that, if unchecked, they will, in some cases, pass on to metritis and other morbid conditions of the uterus, or they may excite an attack of puerperal convulsion.

Whilst a physiological amount of after-contraction of the uterus should never be interfered with, excessive or pathological action should always be moderated, if possible. It is true that we sometimes observe morbid after-pains, by expelling coagula from the uterus, effect their own cure, in removing the source of irritation, just as we see vomiting or purging relieve themselves by the rejection of morbid matters from the stomach and intestinal canal; but we often see vomiting or diarrhœa, when once induced, continue long after the irritating matters have been expelled. And so it is with the uterus. The one is as legitimate and imperative a subject for treatment as are the other two.

At each after-pain the entire uterus is contracted into a hard and painful ball, or it is irregularly contracted so as to feel firmer in some places than in others. It often happens that each after-pain is attended by a discharge of coagula, or of the lochial fluid, though sometimes there is an absence of all discharge per vaginam. In ordinary cases, after-pains increase in severity with every succeeding labour, and as a general rule, they are more troublesome the shorter the duration of the individual labour. Cases, however, occur—those in which there has been dysmenorrhœa, with great irritability at the ovarian periods of pregnancy—in which after-pains are very distressing in primiparæ. As to the seat of the pain, it is partly uterine and partly lumbar, the latter probably being dependent upon the ovaria. Sometimes the contractions are not confined to the uterus, but the abdominal muscles become affected, cramps or spasmodic twitchings of the limbs occur, and the pain which begins in uterine contraction alone, may, by an extension of reflex action, terminate in convulsion.

The main cause of excessive after-pains consists in the excitable condition in which the uterine and ovarian nerves, both as regards reflex action and sensation, are left after parturition. In this state of excitability, the uterus is roused to contractions by the ovarian stimulus, by the state of the surface from which the placenta has separated, by coagula within the uterus, and by various extra-uterine stimuli. Thus when the after-pains are excessive, the physiological reflex relations between the breasts and the stomach, and the uterus, excite the most painful action of the latter. The patient can neither drink nor apply the child to the breast without renewing the agonies of labour. Any emotional disturbance aggravates the suffering; the acts of coughing, sneezing, defecation, micturition, or even voluntary movements of the patient in changing her position, &c., produce violent pains, chiefly because of the compression of the uterus by the abdominal muscles. But the uterus is sometimes in such a tetanic state that the slightest movement of any part of the body excites it to violent spasmodic action.

The treatment of after-pains is very simple. It consists in the removal of coagula from the vagina and os uteri, the avoidance of all the extra-uterine causes of uterine contraction, and the application and administration of opiates. A great objection is made to opiates by some persons, as I have already said. I do not, however, believe that a moderate, or even a full dose of opium, really weakens the uterine contractions; on the contrary, I believe it allays the sensibility of the uterus, and at the same time increases rather than diminishes its contractility. Gentle friction with the linimentum opii over the abdomen is often very useful; but I have found still greater benefit from the application of this liniment to the mammæ. By a reflex action, it allays the excessive sensibility of the uterus, when thus applied. Probably, when applied to the abdominal surface, its sedative influence is also of a reflex kind. The sensorial connexion between the nerves of the abdominal surface and the abdominal and pelvic organs is very striking in some diseases. For instance, in peritonitis, there is actual and intense tenderness of the skin of the abdomen in addition to the tenderness of the subjacent peritonæum. This is a slight digression; but I mention it to show the reflex sensory connexion between the surface and internal organs, which, in the case of after-pains, may be made of considerable therapeutic service.

In excessive after-pains, without hæmorrhage, without the presence of coagula, and in the absence of other the signs and consequences of inertia, the infant should not be applied to the breast for some hours after delivery; not, in fact, until the uterus has become calmed from its state of morbid excitability. Early and constant stimulation of the breasts by the child is a common cause of irritable uterus for many days after delivery. This agency, so salutary in all cases of impending inertia, is often made, unnecessarily, a cause of miserable suffering, at a time when the patient is little able to endure it, and without any counterbalancing good, if the uterus has contracted healthily. I repeat, we want no more than safe contraction; every after-pain beyond this point is both unnecessary and mischievous. By excessive stimulation of the uterus after delivery, the foundation is often laid of prolapsus or procidentia.

It will be useful to compare all these irregular actions with each other. The resemblance between Rigidity of the os uteri and the most simple form of Encysted Placenta—namely, sphincteric closure of the os uteri with retention of the placenta—is at once obvious. The same contracted state of the os uteri is present in Inversion, after the uterus has descended through the os uteri. In the form of encysted placenta, or irregular action of the uterus, constituting Hour-glass Contraction, we have precisely the same condition of the middle portion of the uterus as that which obtains in the second stage of inversio-uteri. In simple hour-glass contraction, the cavity of the uterus is divided into two parts by the contraction of the middle portion of the organ; but when, owing to irregular action of the fundus, this part of the organ descends into the cavity of the uterus, and the hour-glass contraction then occurs, the fundus uteri is seized by the contracting ring of the uterus, borne down through the os uteri and vagina, and inversion is thus rendered complete. After the inversion, the os uteri, which dilates to allow the inverted uterus to pass, becomes firmly contracted. Again: all these abnormal actions, occurring after delivery, are but modifications of excessive After-Pains. In severe after-pains, it is easy to feel with the hand that the uterus becomes hard and prominent at particular points, and soft and depressed at others. From these irregular contractions the more serious irregularities of uterine action arise. Sphincteric closure of the os uteri prematurely, is the most simple derangement; next comes the annular contraction of the upper part of the cervix, or the body of the uterus, in hour-glass contraction; and lastly, the phenomena of inversion, which is the most compound of all these disordered actions. Thus rigidity of the os uteri, encysted placenta, inversion of the uterus, hour-glass contractions, and excessive after-pains, are merely modifications of irregular uterine action, and they are all convertible one into the other.

These views materially simplify our comprehension of these post-partum accidents. Hitherto they have only been treated of in an isolated manner, and with little reference to uterine physiology, or their evident relationship to each other.

[Since the publication of the former lecture, the following case has been communicated to me. It illustrates much that I have said in the last three lectures, when treating of acute or precipitate labour, and excessive uterine action. I gladly insert it here, because I am sure that no one can give more sound or trustworthy testimony on such a subject than my friend, Mr. Henry Smith, the relator of the case, who, though he has written little, has, I venture to say, performed a larger number of physiological experiments than any other man in Europe of the present day. Many years ago, Dr. Marshall Hall dedicated his work on the Circulation of the Blood to this gentleman, who had aided him in the performance of the extensive series of experiments upon which that work was founded. Since that time, Mr. Henry Smith, though engaged in general practice, has occupied himself, almost daily, with experiments upon the nervous system.]

"67, Torrington-square, Nov. 8th, 1848.

"My dear Sir,—I was called by a medical friend, last night, to a case which I think may be worthy of record, as llustrative of the effects of the reflex and spinal actions in parturition. The patient was a young woman, twenty-six years of age, primiparous. The labour was such as you designate 'acute,' the pains being rapid and strong. Examination per vaginam excited strong contractions of the uterus, and even touching the external parts brought on or increased the uterine contractions, and aggravated the pains, so that her medical attendant, finding the presentation and progress of the labour satisfactory, refrained from any further examination or interference. The child was born after a short labour of four hours, but after the head was expelled, an interval of ten minutes elapsed before the shoulders and trunk followed, the uterus appearing to be exhausted. The placenta was removed by gentle traction. It was now found that there was uterine hæmorrhage, with complete inertia of the uterus. The accoucheur applied cold, with pressure, over the uterus, and gave her half a drachm of the ergot of rye. These measures arrested the hæmorrhage, which did not proeed to any alarming extent. Shortly after taking the ergot f rye, she was seized with violent pain and bearing-down, which continued at rapid intervals, so as to alarm the bytanders. I now saw her. The pulse was good, and the heat f the skin and expression of the countenance natural. Violent pains succeeded each other in rapid succession, ccompanied by cramp in the limbs, and trembling and spasmodic contraction of the muscles of the arms and fingers. Pressure over the pubis could scarcely be borne, and introucing the finger into the vagina brought on the pains. The terus was found firmly contracted, and the vagina filled with oagula. Under these circumstances, absolute quietude and he avoidance of every kind of excitement were strictly enjoined. Twenty drops of laudanum were given, and ordered o be repeated in smaller doses, with tincture of henbane and icarbonate of potash, till the pains were relieved. The pains nd spasmodic actions gradually subsided in about five hours, nd when I saw her in the morning, there appeared to be othing unusual. The child was now applied to the breast, which produced only moderate pain, and she made no complaint, nor had any unfavourable symptom.

"This case is peculiarly interesting in three points of view. First. As showing the effect of excitation in producing uterine contraction by reflex action. Secondly. In the succeeding state of exhaustion and inertia of the uterus. Thirdly. In the reproduction, by the ergot of rye, of violent uterine action, accompanied by tetanic or spasmodic contraction of other muscles through the central spinal system.

"I beg you to make any use of the above you please, and remain, yours very truly,

"HENRY SMITH.

"To Dr. Tyler Smith."

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LECTURE XVIII.

EXTRA-UTERINE REFLEX ACTIONS OF AN ABNORMAL CHARACTER, OCCURRING BEFORE, DURING, AND AFTER PARTURITION. FALSE OR SPURIOUS LABOUR-PAINS. METASTATIC PAINS. REFLEX ACTIONS AFFECTING THE STOMACH, ABDOMINAL MUSCLES, BLADDER, INTESTINES, HEART, LARYNX, ETC. RIGORS. DIURESIS. PARTIAL CONVULSIVE ACTION. TYMPANITIS. REFLEX COUNTER-IRRITATION. THE SENSATION OF THE DRAUGHT IN THE BREASTS. THE MOTOR ACTIONS OF THE MAMMÆ.

During, before, and after parturition, a number of irregular reflex actions of a morbid character take place, some of which have been described under different names, and in a disconnected manner, but all of which may, I think, be usefully grouped together as regards practice. Of these the most important are what are called "false" or "spurious" labour-pains, and "metastatic" pains occurring either during or subsequently to delivery.

It might be supposed that in so important a reflex function as that of parturition, various irregular reflex actions would occur, some of them unimportant, others of sufficient importance to complicate or retard labour.

I. The terms, "false pains," "spurious pains," are applied to certain actions which occur before labour, and simulate the true labour-pains with more or less closeness, except that the uterus does not contract with its true rhythm or periodicity; nor does any dilatation of the os uteri, or parturient impulsion of the fœtus, occur. Such pains sometimes affect the abdominal muscles, these muscles becoming contracted spasmodically, at irregular intervals, with pain in the muscles themselves, and tenderness of the abdominal surface. Sometimes these spurious pains consist in a painful state of the bladder; at others, the rectum is the seat of periodic pain; a sensation of bearing-down affects the bladder or rectum, and there are constant but ineffective calls for the evacuation of these organs. Occasionally, the pain, instead of being abdominal or pelvic, is femoral; considerable pain being experienced in the thighs from the ilium downwards to the knee. In some cases these pains affect the uterus itself, and labour is confidently expected. But the uterus, instead of being uniformly contracted, as it is at the true commencement of labour, contracts irregularly; hard and painful balls are formed in different parts of the organ, which are constantly changing their position in the abdomen. Many women suffer in this way during the last two or three months of parturition, and are constantly watching in vain for the advent of labour. Sometimes women of irritable habit, who have had several children, are so pestered by these painful and partial contractions, that they declare they are in labour the whole forty weeks of gestation. This form of spurious pain appears to consist of an exaggerated form of the peristaltic movements of the uterus during pregnancy.

The causes of the various irregular actions which occur before labour are not very difficult of detection. There is, first, that general irritability of the economy which accompanies, or is produced by, the state of gestation. Upon this irritability various secondary causes operate. The most important are, emotional disturbances, such as fright, or anxiety; irritation of the gastric or intestinal mucous membrane by indigestible food, or accumulated fæces; great muscular exertion, want of sleep, and excessive fatigue. Any of these causes are sufficient, towards the close of pregnancy, to excite irregular reflex actions in the uterus, or the other organs affected by spurious pains.

These pains are frequently arrested by quieting the mind of the patient; and nothing tends to do this more than the assurance that labour is not present, or likely to occur immediately. The mind may be further soothed by an opiate, which, at the same time, allays the sensations attending or constituting the false pains. All sources of reflex irritation should be avoided as much as possible. The bowels should be kept free from irritation by the mildest aperients; if sickness and gastric irritation should be present, the promotion of vomiting, by warm water, or chamomile infusion, is often of signal service; the state of the bladder and the renal secretion should also be carefully attended to. When the pains affect the abdominal and femoral muscles, frictions with an anodyne liniment, and warm applications, or the warm bath, should be recommended. Muscular rest is always proper in these cases.

II. During parturition various irregular actions occur, which have been termed "metastatic pains." The term metastasis ought, however, to make way for irregular reflex action, which would describe the phenomena more exactly. The metastatic action is nothing more than this: the reflex motor power, instead of being reflected to the proper muscular structures, affect other muscles which should remain in a state of repose during labour; or certain muscles, which should be in physiological action, are excited spasmodically, while others continue inert when they should be in a state of activity. What may be called an overflow or a misdirection of reflex motor power takes place in these cases.

These extra-uterine reflex actions, of an irregular type, sometimes effect the abdominal muscles in the stage of dilatation, the uterine contractions being more ineffective than usual. Sometimes they consist of spasmodic cramps of the thighs or legs, and I have occasionally seen the hands affected with cramp at each returning pain. In this form of parturient disturbance we ought to include violent vomiting, and violent irritation and action of the rectum and bladder.

Another singular modification of these irregular pains is seen in those cases in which the pains appear to return with tolerable regularity, but are wholly inefficient. There is abundance of physical pain, but little or no motor contraction. Each pain seems to exhaust itself in sensation instead of motion. The pain in such cases does not affect the uterus so much as the back and thighs of the patient.

In almost all these cases the uterus acts imperfectly; the diversions of the reflex function, evidently diminishes its proper physiological activity.

With these irregular extra-uterine actions we must class the rigors which affect the whole muscular system in some cases of labour. I have formerly adverted to the rigor which occurs in many cases at the completion of the dilatation of the os uteri, and which is ordinarily a transient affection. Some women, however, are thus affected during a great part of their labours. Every muscle shakes just as though the cold fit of an ague were present. When these rigors are severe and long continued, they depress the patient very much, and render her quite unfit for the exertions of the expiratory efforts of the stages of propulsion and expulsion. Occasionally, however, they are followed by heat of surface and greater muscular energy than usual. I have never seen them actually pass into general convulsions, but sometimes they have been so severe as to threaten momentarily to end in this disorder.

Each natural labour-pain affects the heart in a slight degree, but after the pain has passed away, the heart's action becomes regular again. In some subjects the disturbance of the heart is much more severe, each pain increasing or diminishing the frequency and force of the pulse to a morbid extent, the effects of which are not recovered from in the intervals between the pains.

During parturition itself, the uterus and ovaria are the great centres of irritation, by which the abnormal reflex disturbances are excited. The uterine irritation must be soothed, as far as possible, on the principles laid down when treating of acute labour. A sound sleep is often more efficacious than any other means in arresting the irregular actions, or changing them into the regular actions of labour. As in spurious pains occurring before labour, all the emotional influences should be soothed, and the reflex causes of uterine excitation furnished by a loaded bladder, stomach, or intestine, removed as far as possible. In these cases, our chief attention must be directed to the reduction of the spinal erethismus which exists, when the irregular and violent actions are pretty sure to subside into the legitimate actions of parturition.

III. After delivery, various irregular actions, related to those we have been considering, take place.

The "rigor" of parturition sometimes occurs with intense severity immediately after the delivery of the child. The dilatation of the os externum appears to produce it, as distinctly as the dilatation of the os uteri in ordinary cases. The most severe rigors I have seen bave occurred between the expulsion of the child and the placenta. The patient suffers from the most distressing sensation of cold; her teeth chatter violently, and she shakes the bed or the whole room with her violent shiverings.

Following upon delivery, we may have a partial convulsion, if such a term be allowable. Each action of the uterus will, in such cases, be attended by spasmodic actions of the extremities and the abdominal muscles, almost like those which occur in cholera. But there is no insensibility, or any of the cerebral complications of puerperal convulsions. Still more frequent is a cramp-like affection of the abdominal muscles, but it would be difficult to decide whether this arises from uterine irritation, or from the state in which these muscles are left after the violent contractions of the latter stages of labour. These cramps and partial spasmodic actions, however, attend the after-pains, and are increased by all the causes of severe after-pains.

Affections of the bladder are very common after parturition; in some cases there is great irritability, with painful spasm at the neck of the bladder on each attempt at micturition; in others, there is inertia, almost amounting to paralysis. It is often a long time before the bladder returns to its natural tone in such cases.

Sometimes the action of the urinary bladder is so excessive that, combined with the abdominal contractions and the relaxed state of the parts within the pelvis consequent upon the evacuation of the uterus, it produces prolapsus of the bladder. This is the more likely to occur, if the ergot has been given before or after delivery, an observation for which I am indebted to my friend Dr. Robert Barnes. The same remark applies to the production of prolapsus uteri after the employment of ergot.

A morbid state of the lower bowel is very common after parturition. Generally, there is a sense of debility, with constipation. During severe labours, when the dilatation of the perinæum is difficult, a considerable amount of prolapsus ani occurs. After delivery this disappears, but there is often great torpidity of the bowel in such cases. Another source of disturbance to the rectum arises from the frequent laceration of the frænum at the anterior edge of the perinæum.

A further reason for inactivity of the bowels, after delivery, arises out of the removal of abdominal pressure from the intestines. This appears to cause a temporary loss of power in their muscular coat. Besides mere inactivity, we sometimes see the intestines enormously distended with flatus, without sufficient power to expel it. This form of tympanitis frequently gives the young accoucheur much anxiety, though the first aperient generally removes all signs of it from the abdomen.

Although, generally speaking, the bowels are torpid after delivery until relieved by medicine; yet sometimes, a day or two after delivery, a spontaneous diarrhœa sets up, apparently excited by the accumulations which have taken place in the colon during pregnancy. Many women have occasional attacks of diarrhœa during the latter part of pregnancy, from the same cause.

Within proper limits, all the extra-uterine actions excited by parturition are as beneficial as the actions of the uterus itself. Among the other organs excited by the parturient uterus, the kidneys deserve to be mentioned. A most salutary diuresis frequently takes place during the first few days succeeding labour. In patients who have suffered from albuminuria during pregnancy, or whose extremities are affected with œdema, the increased action of the kidneys is most beneficial. An œdematous condition of the whole body will frequently disappear entirely during the first twenty-four hours after parturition. Of course, in such cases, it is of more than usual importance to watch the state of the bladder, and to prevent any of the ill consequences of retention.

Among the extra-uterine disturbances of a motor kind, I ought not to omit a peculiar and troublesome cough, from which women recently delivered often suffer much distress. This cough is accompanied by constant irritation of the throat and larynx. It is generally more relieved by food and the pressure of the abdominal bandage, than by sedatives or the ordinary means of allaying cough. I have seen it produce more inconvenience than even severe after-pains. It particularly interferes with the sleep and repose so necessary to recruit the strength of patients recently delivered. Each time that the patient sinks into insensibility, she is roused by a painful sense of strangulation and a prolonged fit of coughing. The cough is purely irritative, being quite unconnected with inflammatory action or increased secretion in the larynx or bronchi. This form of cough, if allowed to continue, becomes most troublesome a day or two after delivery, at the time when the secretion of milk from the breasts is fully established. Some women suffer from this affection in a more moderate form during the whole of lactation, particularly after suckling the child and before taking food.

Thus after the completion of labour we have to deal with morbid states arising out of the highly excitor condition of the uterine and vaginal surfaces, and the associated excitors which are active during parturition, and we have also to consider the paralyzing effects of excessive parturient action upon the uterus and those organs which are in reflex relation with it. The chief indications are, as in the disturbances occurring before or during labour, to subdue the uterine and other excitor tendencies by repose, by soothing measures of a local kind, and the removal of irritation, mental and physical. The organs which have been weakened by the excessive efforts of the uterus should be strengthened by rest and gentle stimulation. Mechanical displacements of course require special treatment. At whatever date of gestation, parturition, or the puerperal state the irregular actions which have been referred to occur, they are to be considered in precisely the same light as excessive or deficient reflex motor actions following the regular reflex channels. Let there be irritation of the intestine, for instance, it makes little difference, as regards treatment, whether the result is simply increased action of the bowels, or whether the excitation is reflected upon the uterus so as to produce uterine action; we have but to remove the cause, and the effect, whether immediate or remote, ceases. But this is obvious, and need not be dilated upon.

Throughout gestation and parturition, the reflex motor actions and synergies excited in distant parts by the state of the uterus are abundantly evident; but the principle of counter-irritation also appears, in some instances, to affect the spinal system in a very remarkable manner. The arrest of the ovarian function during the whole term of pregnancy I have adverted to in a former lecture. I have, during the present course, mentioned that in some instances we see asthma perfectly relieved by gestation, to reappear after parturition. It is well known that the ravages of phthisis are stayed in an extraordinary manner by the condition of the reproductive organs in pregnancy. In some cases of epilepsy, the fits are suspended altogether during gestation. We may have obstinate vomiting during the whole of pregnancy, but with a total disappearance of the gastric irritability as soon as labour has set in. All these and other similar facts require to be classed together for further observation and study. It is evident that the principle of counter-irritation exists, though obscurely, and in rare cases, in spinal pathology and therapeutics; and that physiological or pathological irritation of one organ under the influence of the spinal marrow may diminish the irritation or excitement of other organs. It would be very important if we could define the limits of this form of counter-irritation with anything like accuracy.

When describing the Genesial cycles of ovulation, gestation, and lactation, I have referred to the influence of the parturient uterus, in exciting the secretion of milk in the breasts. I may here mention another singular relation between the uterus and the mammæ. Undoubtedly, it is the after-pains which first excite the sensation connected with the secretion of milk, termed the "draught." At first, it is the after-pains which excite this synergic action in the mammæ, at each time of their occurrence. The "draught" may be considered, in fact, as a part of the after-pain. The same uterine irritation which excites that reflex action in the uterus which constitutes the after-pain, also excites the mammary sensation. After a time, the uterine irritation and motor action cease, but the mammary action is now continued independently of the uterus. Other stimuli besides those connected with the uterus continue to excite it, particularly the excitement of the stomach on receiving food or drink, and the excitement of the nipple by the sucking of the child. Still we cannot, if we consider the matter attentively, refuse to see in the "draught" the residuum, the representative of the after-pain, just as the after-pain is the successor of the true labour-pain. These reflex metamorphoses are in the highest degree interesting. We may observe the gradual transmutation of the throes of labour into the agreeable sensation accompanying the secretion of food for the infant in the mammary organs.

At each returning ovarian period after parturition, these mammary sensations are increased in intensity. This is particularly the case when the catamenia appear during lactation; but the increase is evident even in those cases in which the catamenia are absent.

The orifices of the milk ducts in the nipple appear to be endowed with some amount of motor action. In the nipple of the woman who is neither impregnated nor nursing, a decided amount of erection may take place. This could not occur without some motor provision for retarding the return of blood from the nipple. But the contraction and dilatation of the orifices upon the surfaces of the nipple during lactation are quite distinct from the erectile properties of this part at other times. I consider these orifices to be endowed with a power of contraction and dilatation, because in many cases the sight of the child, or the mere preparation of her dress by the young mother for suckling the infant, or the sensation of the draught, will cause a free flow of milk without actual suction, and this flow will cease on the removal of its causes, as suddenly as it had occurred. At other times, after the withdrawal of the child, the milk is for a short time expelled in a full stream, and to a considerable distance. Some force beyond, and very different to, mere distention, appears to expel the contents of the mammæ. The researches of Professor Owen have demonstrated the existence of a constrictor muscle for injecting the milk into the mouth of the young animal, in the platypus. Some rudimentary provision of this kind appears to exist in the mammalia, and in the human female. In the milking of the cow, the fluid is expelled with far more force than can apparently be attributed to the mechanical action of the fingers of the milkers. The fact that in the human subject the milk is expelled in a strong jet after the suction of the infant, shows clearly that there must be a power of dilatation, and also that, in ordinary cases, the dilatable orifices are firmly closed, otherwise milk must constantly escape, instead of remaining as it does in the mammæ as in reservoirs. I have been told by good authorities, that in savage women the milk will spurt out from the nipple without any pressure or suction by the infant. In some cases, too, of sore nipple, the agony suffered by the mother is quite disproportionate to any visible soreness or inflammation of the part. The nipple may be touched and handled without giving much pain; but the instant the child is applied, severe suffering is experienced, and the child cannot get a free supply of milk. It seems to me, that in such cases there is a painful sphincteric contraction of the mouths of the milk ducts. The lactatory sphincters, if they may be so termed, under ordinary circumstances, remain closed; but they are dilated by the influence of emotion, the sensation of the draught, and the mechanical irritation of suckling. In some cases of sore nipple, it has appeared to me that the irritation which should dilate these orifices, being present to a morbid extent, excites them to painful contraction instead of physiological dilatation.

In these cases, cooling applications, rest to the nipple by partially feeding the child for a short time, or the use of an artificial nipple, are the proper remedies, instead of ointments and astringent applications.

There are three conditions of the breasts which require to be studied with reference to motor action. The erection of the nipple; the distention of the mammæ attending the sensation of the draught, and the increased secretion of milk which takes place at this time; and lastly, there is the dilatation and closure of the lactatory orifices of the nipple. The sensation of the draught appears to be to the whole breast what erection is to the nipple. Each of these conditions—the erectile state of the entire gland, the erectile state of the nipple, and the dilatation and closure of the orifices—must necessarily depend upon some motor action in the mammæ. The motor structures concerned in these actions remain to be discovered.

The laminar ovarium and the simple sexual duct in fishes are evidently archetypes of the complex mammary, uterine, and ovarian apparatus of mammalia. In the progress of the animal scheme, the mammæ have become perfectly distinct in the higher animals from the parturient canal. In the lower mammalia, the breasts are nearer to the other organs of the reproductive system than in the human subject. In the pigeon, the sexual and intestinal canals are connected together and the mammary function is discharged by the stomach, a milky fluid being secreted and returned with the food intended for the young bird. On a future occasion I hope to be able to pursue this interesting subject at greater length.

MANCHESTER MEDICAL SOCIETY

LECTURE XIX.

NATURAL AND MORBID CONDITIONS OF THE REFLEX FUNCTION IN THE INFANT AT THE TIME OF BIRTH. THE INFLUENCE OF MUSCULAR TONE. THE COLOSTRUM. THE MECONIUM. ICTERUS NEONOTARUM. THE ACTS OF SUCTION AND DEGLUTITION. THE STATE OF THE INFANTILE MAMMÆ. MORBUS CERULÆUS. TETANUS NASCENTIUM. CONGENITAL CONTRACTIONS OF THE EXTREMITIES.

Great excitability of the spinal centre and its excitor and motor nerves exist after birth, and particularly after the establishment of respiration. In utero, the fœtus is defended with much care from excitor stimuli, and it has never, up to the time of birth, been influenced with any degree of intensity by that cause which acts upon the surface more powerfully than all other causes—namely, alternations of temperature. Alternation of temperature is the great awakener of the spinal function. During pregnancy, the muscles of the infant appear to be kept in a state of moderate contraction from muscular tone, a property dependent upon the spinal marrow, and to this I have attributed the ovoid position and the consequent presentation of the fœtus in the natural manner. All the muscles seem to be contracted by what John Hunter called the "sphinctorial action" of muscles, being uninfluenced by volition or emotion, and only slightly by reflex action. In consequence of this uniform contraction of the muscles, the flexors, as the strongest, curve the body into the shape preserved by the fœtus during pregnancy, and which becomes most perfect at the time of parturition. This contraction of the body and limbs is very evident when turning is performed, in cases of head-presentation. Besides the influence of tonic contraction in producing the ovoid shape of the fœtus, it acts in keeping the individual limbs in their proper position. If the limbs were freely moveable by reflex action or otherwise, arm-presentation must inevitably be very common; but the closure of the arms and hands across the breast prevents this in the most perfect manner. This sustained position of the arms is an adjunct during labour to that peristaltic action of the uterus from the os uteri upwards, which tends to prevent the arms from being forced down with the head during the pains. After birth, and the establishment of respiration, though the reflex function comes into full operation, the contracted state of the limbs is very evident. The contraction of the hand and foot is indeed often so great as to produce the apprehension of deformity. It becomes the first business of volition and emotion to exercise the muscles of the limbs, so as to free them from the ante-natal contraction, and reduce them ultimately to the influence of volition and emotion. Every voluntary and emotional movement contributes to this end, and so, probably, do the reflex movements of the limbs which so constantly occur during infancy; but experience shows us that it is long before the limbs of the child become perfectly mobile.

Under the influence of new and powerful stimuli, the reflex actions which constitute the first external life of the infant are subject to various derangements. Shortly after birth, children are subject to special disorders, some of which never occur after early infancy. I propose briefly to consider the ailments thus produced. Some are caused by the ingesta and egesta, others by various causes operating on the excitor nerves of the surface, and some, perhaps, upon the spinal marrow itself.

The Colostrum sometimes produces sickness in the child for several days after the first secretion of milk, each attempt to take the breast being followed by retching or actual vomiting. The gruel, sugar, butter, &c., which nurses are so fond of dosing children with before the milk appears, under the false impression that they must otherwise be starved, contribute to the derangement of the infant stomach, as yet unused to ingesta of any kind. Medicine is seldom if ever required in these cases; after a short time, the milk secreted becomes less irritating, and the stomach of the child grows more accustomed to ingesta. If the sickness should be troublesome, the breasts of the mother should be drawn for a day or two, to remove the irritating secretion, and the child fed with gruel or arrow-root.

The Meconium generally purges the new-born infant, and a meconic diarrhœa may occur soon after delivery, accompanied by considerable pain, and a tenesmus of the lower bowel. Disturbance of the bladder is also likely to occur. Either the urine first secreted by the kidneys is too irritating in some cases, or the irritation of the rectum affects the bladder reflexly, for some amount of difficulty and pain in evacuating the urine is found to be common during the first few days after birth. In cases of marked vesical irritation, I have seen infants only a few hours old affected with complete erection of the penis. Of course this act is in such cases purely physical and reflex. If the meconium should either prove too irritating, or if the dark evacuations should continue longer than usual, a dose of castor oil is all that is necessary to remove this matter from the intestines. To relieve the bladder, and the painful state of the rectum, warm fomentations, or a sponge wrung out with hot water, and placed over the genitals and perinæum, are very efficacious. In cases of mere retention, either of the fæces or urine, the application of cold will sometimes excite reflex action of these organs. In breech presentations, the afflux of cold air to the nates, as well as the mechanical pressure, produces the expulsion of the meconium. Throughout infancy, nurses, while encouraging children to the evacuation of the bowels and bladder, instinctively blow with the breath upon the face or belly of the infant, and thus assist in producing the reflex phenomena of these actions. When the fœtus is dead, the escape of the meconium, during or before labour, is purely mechanical; but when living, it is partially or entirely a motor action.

The Icterus Neonotarum, which so frequently affects the new-born infant, is a very curious affection. In three or four days after birth, this partial jaundice is at its height, all the tissues, as well as the skin, being sometimes stained of a bright yellow colour. In children in whom the affection is severe, and who happen to die at this period, the layer of fat beneath the skin is almost as deeply coloured as the skin itself. There are certain phases through which, in the opinions of nurses, a child has to pass before it reaches its proper fairness of complexion. At first it is of a bright red colour, from the effects of the air upon the surface, from which the caseous matter which covered it at birth has been removed. After the redness has reached its acme, the icterode tint begins to appear, and it is usual for nurses to prognosticate the fairness and beauty of the infant, from the intensity of these colours in the first instance. I suspect this form of jaundice depends on spasmodic closure of the gall-ducts, in consequence of the passage of the first ingesta along the duodenum. In its mildest forms, this condition can hardly be considered pathological, or if so, it is almost universal, for there are few children in whom, a few days after birth, the bile-tint may not be discovered in the skin or conjunctiva. It seldom lasts more than three or four days, its subsidence being as spontaneous as its appearance. A mild aperient, repeated once or twice, or warm water enemata, are sometimes required in severe cases.

The acts of Suction and Deglutition are performed with the utmost perfection immediately after birth. We seldom have to observe any inability in these respects. As soon as the child has breathed it begins to suck its own tongue, and use its lips busily in the movements of suction. Even before respiration has taken place, it will suck the finger placed in its mouth, or at all events seize it firmly. After the establishment of respiration, the mere action of the air upon the lips excite the movements of suction. The slightest touch of the lips or neighbouring skin excite them most readily. Children, even during sleep, will embrace the nipple firmly between their gums, and it is remarkable that premature children hang upon the breasts by the mouth more constantly than those born at the full term; in this point of view bearing some resemblance to the young of marsupiata, which are actually suspended from the mammæ by the contraction of the mouth in sucking. I have seen the movements of sucking as perfectly performed by an acephalous fœtus as by a well-formed child. This shows that the act is entirely independent of the cerebrum. It is remarkable that suction, as a reflex act, should be almost lost after the period of infancy has passed. With the development and appearance of the teeth, an alteration of the nervous endowments of the mouth must take place, by which mastication becomes substituted for suction. A curious part of the mechanism of sucking, is the ring or ridge of bullæ which appears on the inner surfaces of the lips of infants, forming as it were a double labial apparatus. After a child has taken the breast this appearance is seen at its height, when it slowly disappears until the next application of the infant.

Writers on psychology have always been puzzled by the first movements of the fœtus after birth, unknowing, before the discovery of the reflex function, to what motor powers of the economy to refer them; hence the most ludicrous mistakes have been made in the discussions upon the intellect and instincts of the newly-born fœtus. An analysis of the earliest and purely reflex and physical movements of the fœtus and infant will form a most interesting chapter, at the very threshold of psychology, and one which is as yet entirely unwritten. The time and manner in which emotion and the will become mixed up with the purely physical movements, will be well worthy of study, but it is beyond all qnestion, that before the nervous centres have been acted upon by the changes occurring in the blood from respiration, there is, and can be, no more sensation, emotion, or volition, than pertains to a state of asphyxia. All the movements up to this point of existence are physical, and so are all the chief actions which occur immediately after the establishment of respiration. The very perfection of the acts of suction and deglutition at birth depend upon their being physical and not psychical acts. To insure the perfect sucking of the child, it is only necessary that the placing the child at the breast should not be too long delayed, and that the nipple should be of a proper size and prominence. Malformations of the mouth of the infant are of course excepted. Though the oral actions of the child are generally perfect, the results to the mother are often most painful and disagreeable. The reflex closure of the gums upon the nipple is so rough as to quite mangle it, producing those fissures which are so troublesome to young nurses, and which often render the early period of lactation a most harassing business. As a result of suction in these cases, the nipple is sometimes completely removed, the organ being incised by the gums of the child as cleanly as though it had been removed by the knife.

The Infantile Mammæ are in a very curious condition at, and shortly after, the time of birth. These glands in the child of both sexes, secrete milk, sometimes in considerable quantity. Nurses squeeze the secretion from the breasts, particularly in female children, though it is quite as abundant in the male, with an idea, as they term it, of freeing the "nipple strings." This notion is absurd enough, but the secretion may be so profuse as to require its removal, lest suppuration should ensue. Where the breasts are not relieved, the secretion thickens to the consistence of curd, and each gland becomes converted into a hard and painful tumour. In the young infant the nipple is very imperfectly developed, and the opening of the gland appears to consist of a single round orifice, or depression; whether this part possesses any motor properties, I cannot say, probably it does not. I merely refer to it as one of the orifices of the body at the time of birth, and which, like the others that have been mentioned, is at first unusually irritable. After the subsidence of the infantile secretion, the breasts become quite inactive, until they are developed in the virgin by the stimulus of puberty.

The Morbus Cœruleus can hardly be considered as a motor derangement. It arises from the mechanical continuance of the open state of the foramen ovale, and the consequent admixture of the blood of the two sides of the heart. The cause of the convulsions occurring in this condition is obscure. They may be referred either to irritation of the heart itself, or to the circulation of venous or mixed blood in the arteries. But it is less important to discuss this malformation and its consequences, as they are almost beyond the reach of remedies.

Tetanus Neonatorum is a disease of more importance than any of the morbid conditions which have just been considered, but it is fortunately a rare malady in this country. The pathology of this affection is at present very little known. It could not well assume a precise form without the knowledge of the reflex physiology of the spinal marrow. Tetanus appears to be excited in infants a few days after birth, by irritation of the umbilicus; by irritation of the intestinal canal; by the influence of temperature, particularly alternations of temperature; and by deficient ventilation, and neglect of cleanliness.

We can readily understand how, in some cases, irritation of the umbilicus, in consequence of the decay and separation of the umbilical cord, should excite the spinal centre, just as a wound produces tetanus in the adult, particularly when we consider the excitable condition of all the spinal functions immediately after birth. We can understand, too, that the irritable condition of the sphincters and the intestinal canal, when acted upon, for the first time, by their appropriate stimuli, may sometimes be the cause of this disease. These are the chief eccentric causes of spasmodic disease to which the young infant is liable, if we except the convulsions of primary and secondary asphyxia, which have already been treated of in these lectures. The excitability of the spinal function is continued throughout infancy, as shown by the tendency to convulsions after operations, and the laryngismus and convulsions of dentition. The eccentric causes of trismus nascentium appear to be aggravated by other agencies, such as deficient ventilation, and the influence of temperature, &c.

But these latter causes of infantile tetanus may produce the disease of themselves. It is comparatively prevalent in warm countries, where women, soon after delivery, bathe themselves and their infants in the waters of rivers and lakes, such children being placed, thereby, in the extremes of heat and cold. Tetanus from cold is not confined to infants. It is well known that adults, after sleeping in the open air by night, or after severe exposure to cold of any kind, are sometimes attacked with tetanus. That very common affection, contraction of the sterno-cleido-mastoid, and other muscles of the neck, after exposure to cold winds, seems to be as much a tetanic affection as trismus itself. I have seen cases of this kind of torticollis which could not but be considered as local forms of tetanus. But how does cold in the infant or in the adult produce the tetanic affection? What are the avenues by which they affect the spinal centre? These questions require to be answered, and there are, unfortunately, but few facts or experiments which bear upon them. A series of experiments showing the influence of extreme and continued cold upon the nervous centres would be very valuable. In the case of the brain, we know that extreme cold produces insensibility before the destruction of life. Torpor of the cerebral faculties is one of the first indications of the dangerous effects of cold. In these cases of death from cold, how is the cerebrum affected? Is it through the blood, its languid circulation or congelation, or is it by the physical influence of cold on the nerves of sensation and the cerebrum; or, thirdly, is it by a reduction of the temperature of the brain itself? Similar questions may be asked respecting the spinal marrow and the tetanus which follows upon the application of cold. Does the cold affect the spinal centre and its excitor and motor nerves mediately or immediately; are the muscles themselves affected to any great extent; or is the influence of cold felt through the peripheral or the central portions of the spinal system? There are reasons for believing that both the brain and spinal marrow; the centres and the nerves of sensation and volition; the excitor and the motor nerves; are all simultaneously affected. A limb affected with cold becomes at once insensible, involuntary, and in-excito-motor. The nerves are incapable of transmitting impressions in any direction. In the infant, both the cerebrum and spinal centre are less perfectly defended, anatomically, against cold than in the adult.

The primary effect of cold, both as regards the brain and spinal marrow, and their nerves, seems to be that of paralysis; this effect extends to the entire nervous system, and it may at once be carried to a mortal extent. But the tetanus produced by cold is secondary, perhaps reactionary; it is slowly induced, and it does not appear until the immediate effects of exposure to cold have passed away. This secondary effect of cold is apparently a derangement of the spinal centre. All that we can say, in the present state of our knowledge, is, that cold appears to affect the polarity or excitability of this organ, which, in certain cases, augments until, in children or adults, tetanus is established.

An able American physician, Dr. Sims, has recently endeavoured to show that infantile tetanus may depend upon the imperfect ossification and articulation of the cranial bones, which permit, in some cases, the pressure of the occipital bone upon the medulla oblongata, during and subsequent to parturition. The most important proofs of the truth of this view adduced by Dr. Sims, are those derived from treatment. He appears to have found the convulsions relieved by the re-adjustment of the cranial bones. There are, however, as it appears to me, weighty objections to such an hypothesis. Displacements and injuries of the cranial bones, if they really occur, must be as common in this country as in America, whereas tetanus is extremely rare amongst us. I have seen, too, the convulsions caused by pressure on the medulla oblongata in an anencephalous fœtus, and they bore but little resemblance to tetanus.

Other agencies besides cold and mechanical injury produce similar results, such, for instance, as heat, thermometric variations, deficient ventilation, and, probably, electrical conditions of the atmosphere. Hence it is that infantile tetanus is sometimes epidemic in particular localities, in tropical climates. In this it resembles the traumatic tetanus of armies, which rages or is absent at particular times. Thus we may make out with tolerable distinctness the centric and the eccentric varieties of tetanus neonatorum.

The treatment of infantile tetanus, so far as we are acquainted with it, may be summed up in a few words. It consists in the removal of all sources of irritation of excitor nerves, and in the avoidance of all physical stimulus. Absolute quiet should be preserved as far as possible. A fit of crying, any voluntary or reflex action, even respiration, may pass into the tetanic spasm and destroy life. In the tetanus of adults, apparently the most trivial impression upon the skin, such as standing on a cold floor, or putting on a cold shirt in changing the linen, have each destroyed patients after the disease had appeared to be quite subdued.

Congenital Club-foot and Deformities of the Hand appear, in many cases, to be little more than an exaggeration or perpetuation of that state of tonic contraction of the extremities which is natural to the fœtus in utero. At the time of birth in the human fœtus, an amount of contraction frequently exists which would be pathological in the adult. The feet are generally contracted inwards, and the hands are often contracted laterally, the fingers being turned outwards away from the thumb, so as to place the phalanges almost at right angles with the metacarpal bones. This contraction of the hand is sometimes seen in the adult exactly as it exists in the young infant, and is a very disagreeable deformity. It is a tonic contraction of the muscles, and is quite different and opposite to the reflex or convulsive action in which the thumb is turned inwards into the palm. In the case of the feet we see the first efforts at walking attended by a considerable amount of reflex action. Every time the child is placed upon the ground, the feet fly off from the surface, so that it is difficult to keep them steady, and this constitutes one of the difficulties in teaching infants to walk. Probably it becomes an additional cause of talipes, when the surface of the sole is unusually excitor, and when the child is placed upon its feet injudiciously. There are certainly cases on record in which contractions have occurred to adults from excessive reflex actions excited in the lower limbs. Many of the deformities of youth, and some of the operations of orthopædic surgery, would, I strongly suspect, be saved by attending to the condition of the limbs of infants soon after birth, and at the time of the first attempts at walking. Dr. Marshall Hall has even thrown out the suspicion, that some cases of talipes may be caused in utero by contractions excited by the practice of applying the cold hand to the abdomen during pregnancy.

Such is a very brief sketch of the more important disorders of the Reflex Function which occur shortly after birth.

Everything relating to the beginnings of independent life and mind in the fœtus is also most interesting in a physiological point of view. It is by attending to physiology rather than to metaphysics that we shall be enabled to solve some of the profound problems proposed by Locke, respecting the origin of ideas. We must study the order in which reflex and centric spinal actions of the muscles, (the first extra-uterine movements of the muscular system,) the oxygenation of the blood, and the consequent development of sensation, emotion, with the movements of emotion, volition, and Consciousness, occur. Studied step by step, they may be made the interpreters of each other. Our great metaphysician has been blamed for studying the origin of ideas in the infant; but it may eventually appear, that he was only wrong because sufficient data did not exist in his day upon which to base the inquiry he had undertaken.

LECTURE XX.*

PUERPERAL CONVULSION. OPINIONS OF CONTEMPORARY AUTHORS IN THIS COUNTRY RESPECTING THE CAUSE OF PUERPERAL CONVULSION. EXTRACTS FROM DRS. F. H. RAMSBOTHAM, RIGBY, BURNS, ROBERT LEE, FLEETWOOD CHURCHILL, LOCOCK, COLLINS, AND MERRIMAN. OPINIONS OF DR. MARSHALL HALL. THE CEREBRAL HYPOTHESIS; ITS ERRORS, AND THE CAUSES WHICH HAVE GIVEN RISE TO THEM. CONVULSION REALLY REFERABLE TO THE SPINAL MARROW AND NOT TO THE BRAIN. POST-MORTEM FALLACIES. CAUSES OF THE CEREBRAL PHENOMENA OF CONVULSION. MODES IN WHICH MORBID STATES OF THE CEREBRUM MAY CAUSE CONVULSION. DISTINCTION BETWEEN CAUSE AND EFFECT IN THE PATHOLOGY OF THIS DISEASE.

Eclampsia parturientium, puerperal epilepsy, or puerperal convulsion, as the convulsion of parturition is called by different authors, is one of the gravest maladies met with in obstetric practice. The best and most common term is puerperal convulsion, except that it must be held to include convulsion occurring at any period of pregnancy, and for some time after delivery, as well as during parturition. Every convulsive attack occurring between the commencement of pregnancy and the close of lactation is impressed with peculiar characters depending on the condition of the nervous system which obtains during the processes of reproduction. Setting aside tetanus and hydrophobia as special affections, all convulsive disorders may be arranged in three groups—1. The convulsion of infancy; 2. The epileptic convulsion; and 3. The convulsions which belong to the eras of gestation, parturition, and lactation.

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* The substance of the present and the three succeeding lectures appeared in the *Lancet* in 1844 and 1845.

Before endeavouring to apply the physiology of the reflex function to the explanation of the causes, and the principles of treatment, of puerperal convulsion, I propose to display the various opinions of contemporary writers in this country. The following extracts from authors of reputation contain the most recent views which have been propounded concerning the nature and causes of this disease.

I. "The most usual *proximate* cause of puerperal convulsion is, probably, *pressure on the brain*, this pressure being sometimes produced by the rupture of a vessel causing a sudden effusion of blood; sometimes by serous exudation into the ventricles or between the membranes; sometimes, and by far the most frequently, *by simple congestion of the cerebral vessels themselves.* But the disease has often proved fatal, without any organic lesion being evident on dissection, and without even the vessels being observed to be preternaturally full.—Into the *remote* causes it is not my wish to enter at any length, *because the subject is at best but unsatisfactory, and little understood.* They have been ascribed to articles of food remaining undigested on the stomach, or irritation existing in some other part of the alimentary tube; to general irritability of constitution; to a delicate and luxurious mode of living; to the depressing passions; to an overloaded state of the system; to over-distention of the uterus; to distention of the bladder; and to the death of the child. But the affection, in my opinion, originates most frequently in some deranged state of the uterus itself, probably in its nervous system, and consists in *some irritation propagated from that organ to the brain.*"—Dr. F. H. Ramsbotham, "Principles of Obstetric Medicine and Surgery."

II. "The exciting cause of eclampsia parturientium is the irritation arising from the presence of the child in the uterus or passages, or from a state of irritation thus produced continuing to exist after labour. The predisposing causes are, general plethora; the *pressure of the gravid uterus upon the abdominal aorta;* the contractions of that organ during labour, by which a large quantity of the blood circulating in its spongy parietes is driven to the rest of the system; constipation; deranged bowels; retention of urine; previous injuries of the head, or cerebral disease; and much mental excitement. Also, 'in persons of hereditary predisposition, spare habit, irritable temperament, high mental refinement, and in whom the excitability of the nervous, and subsequently the sanguiferous, system, is called forth by causes apparently trivial.'"—Dr. Rigby, "A System of Midwifery."

III. "Convulsions of the kind I am considering evidently are connected with gestation or parturition; they occur at no other time, and are more frequent in a first labour. . . . . They arise particularly from uterine irritation, but also seem frequently to be connected with a neglected state of the bowels. . . . . The sympathetic irritation is almost invariably accompanied by an affection of the vascular system, productive of *great determination to the head*, either directly or indirectly, through the medium of the spinal nerves, which aggravates the evil, and becomes indeed the chief source of danger. I am inclined to think that, in a majority of instances, *the spinal cord is first affected* by the state of the uterine nerves, and immediately afterwards the head suffers. . . . . A strong predisposition is given to this condition of the nervous system by a bad state of the bowels, and labour seems to bring the matter to a serious crisis. . . . On inspection after death, we sometimes find turgescence of the vessels of the brain, or slight effusion of serum, but very often no mark of disease is to be discovered anywhere."—Dr. Burns, "Principles of Midwifery."

IV. "Those women are most predisposed to the disease who have had hysteria or epilepsy in early life, who have suffered from injuries of the head, or who have had violent attacks of fever, with severe affections of the brain. Depressing passions of the mind appear to produce a predisposition to the disease. Unmarried women, who are excluded from society, and often addicted to the improper use of stimulants, are peculiarly liable to puerperal convulsions and mania. Terror, and other violent mental impressions, and sometimes the pains of labour alone, are sufficient to excite convulsions. The disease occurs, not only in strong plethoric young women with their first children—in such as are of a coarse thick make, with short thick necks—but in weak, irritable, nervous females. There are some cases where irregularities of diet, especially the use of very indigestible food and stimulants, appear, without any other cause that can be discovered, to give rise to the disease. There are many cases in which the peculiar condition of the nervous system of the uterus appears to be the sole cause, and in all cases it is the principal predisposing cause, for the fits of convulsions occur in most women in the first pregnancy and labour, and at no other time but during pregnancy and labour; and they often suddenly cease when the labour is completed, after every remedy has been employed, without avail, except artificial delivery. *The condition of the brain, on which the loss of consciousness and convulsions depends,* is obviously produced by sympathy with the nervous system of the uterus; and the fits return and increase in violence, till the uterus is emptied of its contents, and it is on them the irritation of the nerves of the uterus alone depends." —Dr. Lee, "Lectures on Midwifery."

V. "*It is exceedingly difficult to state anything very definite as to the cause of epileptic (puerperal) convulsions.* Doubtless they arise from the *sympathy of the brain* with the irritation of some different, and often distant, organ—it may be the stomach, the uterus, or the bowels. Intemperance in eating or drinking may give rise to it. Persons previously afflicted with convulsive affections are certainly predisposed to them at this time. Mental emotions and frights occasionally cause convulsions. In some cases, doubtless, they are owing to the efforts made during the labour-pains, by which an accumulation of blood takes place in the head. Atmospheric influence appears to have some effect in determining the frequency of the disease."—Dr. Fleetwood Churchill, "Theory and Practice of Midwifery."

VI. "The immediate causes of puerperal convulsion are often *very obscure*. They appear sometimes *to depend on a loaded state of the vessels of the brain;* at other times, the brain appears to be influenced by distant irritation, either in the uterus or in the digestive organs; and again, in some cases, puerperal convulsions are induced by a peculiar irritability of the nervous system.—The immediate attack may be brought on by a loaded or disordered stomach, or by food, however small in quantity, of an indigestible kind. Some substances—shell-fish, for instance—have been found very frequently to induce convulsions in the puerperal condition, when at other times they may have been taken by the same individual with perfect impunity. A sudden fright, afflicting intelligence, or any unexpected or depressing mental emotion, may excite the paroxysm.—The violent straining caused by labour-pains, and even the disturbance of the frame by the earlier uterine contractions, *causing a temporary rush of blood to the head*, will sometimes bring on convulsions."—DR. LOCOCK, "Cyclopædia of Practical Medicine."

VII. Speaking of the relative frequency of convulsions in head-presentations, Dr. Collins observes, "This fact might be brought forward to support the opinion that puerperal convulsions were caused by the irritation produced in the dilatation of the mouth of the womb. This, however, is not the case, as we not unfrequently find patients attacked when the os uteri is completely dilated, and all the soft parts relaxed. *I conceive we are quite ignorant as yet of what the cause may be, nor could I ever find on dissection any appearance to enable me to even hazard an opinion on the subject.*"—DR. COLLINS, "Practical Treatise on Midwifery."

VIII. "There have been three especial causes assigned as usually producing this disease:

1. General irritability of the constitution.
2. Irritability of the *uterus* from distention.
3. An overloaded state of the system.

"And practitioners have been influenced in their treatment of the complaint by the opinions they have entertained of its cause: thus, those who have attributed the convulsions to general irritability, have considered opium as the proper remedy; those who have thought distention of the *uterus* the cause, have recommended immediate delivery; those who believe an overloaded state of the system to be the cause of the convulsions, employ large bleedings, and other evacuants."—DR. MERRIMAN, "Synopsis of Difficult Parturition."

These quotations are sufficient to show the very great discrepancy and uncertainty of opinion which has prevailed among the most eminent obstetric writers respecting the *causes* of puerperal convulsion.

As a contrast to this confusion, the views of the discoverer of the functions of the *Spinal Marrow* may be brought forward. With a few graphic and masterly touches, he stamps the malady as one of the diseases of this division of the nervous system. He says :—

"The principal *causes* of puerperal convulsion, besides *the peculiar condition of the uterus itself*, are, indigestible food, a loaded and morbid state of the bowels, a distended condition of the bladder, &c., mental shock or anxiety, muscular effort, hæmorrhage, &c." Dr. Marshall Hall further believes, that all these and similar causes act upon the spinal marrow and its system of excitor and motor nerves. This view of the subject I propose to develope at greater length than Dr. M. Hall has hitherto done, but in accordance with his physiological and pathological doctrines. One of the chief sources of error respecting the true pathology of puerperal convulsion is, the incorrect idea which is commonly held by practical men respecting the part played by the vascular condition of the brain in its production. As a preliminary step, therefore, it must be of great importance to attempt to place this matter on a correct physio-pathological basis.

It may be gathered very plainly, from the quotations given above, that the general opinion is in favour of considering direct or secondary *cerebral congestion* as the grand cause of convulsions in the puerperal state. By this, obstetric writers mean congestion of the *whole* organ, or, at all events, they have never, so far as I am aware, made any attempt to define the part of the brain which must be affected before convulsions can occur, a matter of great moment, both in pathology and practice.

It is a well established fact in experimental physiology, that mechanical irritation of the spinal marrow within the theca vertebralis, of the medulla oblongata, and the corpora quadrigemina, will cause convulsions. It is also well proved that irritation of every other part of the brain and cerebellum may be carried to any extent without producing convulsive action.

Loss of voluntary motion may be thus caused, but the involuntary and spinal motions, those which in morbid excess constitute spasm and convulsion, remain unaffected. When the whole of the lobes of the cerebrum and cerebellum have been carefully removed, convulsions may be occasioned to any extent by irritation of the cranial termination of the spinal marrow. All these data have been abundantly proved by the vivisections of MM. Magendie, Schoeps, Flourens, Hertwig, and Dr. M. Hall. In one interesting experiment performed on the dog, Dr. M. Hall found, that while irritation of the brain produced no effect, pinching the dura mater lining the cranium, to which branches of the fifth are distributed, excited convulsions, so that the brain is actually *in*-excitor of spinal action, while the meninges are strongly excitor. The brain itself, although the sensorium commune, has neither nerves of common sensation nor of excito-motion. This is supported by pathological observation. A tumour gradually developed in the brain itself may excite no cerebral or spinal symptoms, while a spicula of bone on the inner surface of the skull may occasion epilepsy. When the tumour does produce convulsion, it is either by pressure on the medulla oblongata, or the extension of irritation to the membranes.

It would appear to be a necessary deduction from these and numerous other facts, that whether we use the term spinal marrow, or any other term, we are bound to consider the medulla spinalis and oblongata with the corpora quadrigemina, as forming together one distinct organ—as being a division of the nervous system, which pathologically, as well as physiologically, must be looked on as separate from the brain, the cerebellum, and the simple sensory and voluntary nerves. Long ago Professor Müller proclaimed, "This is an important distinction which we owe to Flourens, and must at a future period have a great influence on the pathology of cerebral diseases."

Thus, then, we should have—1. The *Cerebral System*, composed of the brain and cerebellum, in connexion with that part of the spinal *chord* which conveys sensation and voluntary motor power to and from the brain, which might be termed the intra-vertebral chord ; and 2. The *Spinal System*, consisting of the spinal marrow, (exclusive of that part of it devoted to the functions of volition and sensation,) together with the medulla oblongata and the corpora quadrigemina. This division into the Cerebral and Spinal systems, though they are each of them both cranial and vertebral, as regards anatomical position; the spinal extending into the brain, and the cerebral situated partly within the vertebral canal, is in nowise theoretical, but a matter of fact, admitting of the most severe physiological proof. Such a division is of great moment for our present pathological purposes; and it is necessary, as we proceed, to keep the mind close to the subject, drawing a clear line of demarcation between those parts which belong to each respectively. We *cannot* have convulsion without the pre-existence of some irritation of the spinal division of the nervous system. Clearly, we cannot get convulsion from the cerebral portion alone. It is a most striking fact, that the anencephalic infant *dies of convulsion*, in the complete absence of the cerebrum.

Let us now glance a moment at some of the presumed causes of puerperal convulsion; and first of all, let us consider the subject of cerebral congestion.

During the pregnant and puerperal states, there is a greater tendency to fulness of the circulation than at other times, and in labour, especially in some of its stages, this vascular plethora particularly affects the head. In the second stage of labour, when the presence of the head of the fœtus in the vagina has excited the reflex action of the expiratory muscles, there is, during every pain, partial or entire closure of the glottis. This interferes with the circulation; and moreover, during the severe pains, a state of partial asphyxia takes place, as may be seen by the distended state of the veins of the head and neck. The same venous congestion must occur in the medulla oblongata and the spinal marrow, owing to the impediment to the return of venous blood, particularly its upper portion, though this has escaped the notice of writers on the subject.

It would follow from the above, that if simple pressure on the cerebral vascular system caused convulsions to as great an extent as obstetric authors generally suppose, they ought certainly to occur far more frequently during the second stage of labour than at any other time. But this is not the fact, as patients frequently fall into convulsions before labour has commenced, or during the first stage, when the respiratory system is undisturbed, or the patient may pass through the second stage of labour, when the disturbance of the circulation is at its maximum, without any sign of convulsion; and the fits often appear for the first time, after delivery has been completed.

These facts alone are, I submit, sufficient to overturn the most generally received opinion as to the *cause* of puerperal convulsions. The error has arisen partly from observing the immense distention of the vessels of the upper part of the body during the paroxysm, and partly from the congestion and serous or sanguineous effusion sometimes found after death. But it can be made clearly evident that these signs are, in the majority of cases, not so much the *causes*, as the *results*, of the disease. Rarely, excepting in convulsions occurring during a pain in the second stage of labour, can the congestion of the brain be fairly considered the *first exciting* cause of the convulsions; and even here we have other causes in operation—the irritation of the excitor nerves of the uterus, and the erethismus of the spinal marrow, as well as the vascular fulness within the cranium.

In this and many other diseases there has been a great tendency to consider any morbid change discoverable *after death* as the cause of the malady present *during life*. *Post hoc, ergo propter hoc*, has had too extensive an application in this department of pathological reasonings. It has been usual, in fatal cases of puerperal convulsions, to examine the brain, and to place all the lesions discovered in it on record, as causes of the disease. Yet what could be more unphilosophical than, in a case of convulsions from afflicting intelligence, followed by effusion into the ventricles and death, to assign the effusion as the cause of the malady. The patient falls into the convulsion *instantly, on the very moment*, that she hears of the death of a friend ; she recovers her sensibility, but the convulsion is repeated, and she gradually becomes comatose, and expires. In such a case there can be no doubt but that the *emotion* is the *cause* of the disease, and that the effusion is an *effect* of the obstructed circulation within the cranium which the convulsion always causes. Practitioners have been further misled by the headach and other cerebral disturbances frequently preceding the fit, and by the marked unconsciousness during the fit itself, and often in the intervals. Thus attention has been diverted from the convulsive action which is the essential part of the malady, and from its especial seat in the spinal, rather than the cerebral, portion of the nervous system.

To go a step farther, and inquire in what mode the obstructed circulation is commonly produced, with its sequelæ of cerebral congestion, effusion, hæmorrhage, &c. In the first place, the contractions of the uterus propel a certain quantity of blood from its parietes into the rest of the system. In the next place, the violent spasm of all the muscles of the body in connexion with the spinal marrow during the fit, must, in a similar manner, pour out a still larger quantity of blood into the arteries and veins. But the most efficient cause is the venous congestion which takes place from the spasmodic closure of the glottis and the sphagiasmus, which interrupt oxygenation in the lungs and the return of the blood from the head.

These are, I believe, the efficient causes of the serous effusion, coagula, and vascular detention, sometimes found after death from puerperal convulsions, and which are so generally referred to as the causes of the disease. It will be seen that I have taken no notice of the pressure of the gravid uterus upon the abdominal vessels, on which some writers have insisted. It appears to me, that if the uterus pressed only on the abdominal aorta, we might recognise such pressure as a cause of vascular distention in the upper part of the body; but it presses equally on the inferior cava, nay, if any difference, still more than on the aorta, because of the different structure of the arteries and veins; so that we ought to look on this variety of compression as an efficient tourniquet taking off the pressure of the blood of the inferior extremities, instead of a cause of cerebral congestion.

But though physiological and pathological facts and reasonings lead us to the conclusion that the hemispheres of the brain can have no direct influence in causing convulsion, yet in the true puerperal attack, and in epilepsy, the brain is indubitably affected during the fit, while in the spasms of tetanus and hydrophobia, sensation and the intellectual faculties remain unimpaired.

Dr. M. Hall attributes great influence to the spasmodic closure of the glottis in convulsions attended by loss of sensation, and its open state in hysteric attacks, or spasmodic diseases in which sensation is preserved. He points out that for some days or hours before the accession of the epileptic or puerperal convulsion, there is sometimes stiffness of the muscles of the neck, and an affection of the larynx, made evident by an alteration of the voice. To the effects of these muscular contractions in the neck in impeding the return of blood by the veins, and to the effects of the partial or entire closure of the glottis in obstructing the circulation, and causing asphyxia, Dr. M. Hall is inclined to refer the sudden annihilation of consciousness which takes place in epilepsy and puerperal convulsions, and also the loss of consciousness without convulsion; the spasmodic contractions acting in much the same mode as the pressure of the cord on the veins of the neck and the larynx, in strangulation. I shall have to describe hereafter the manner in which eccentric irritation may, it is believed, excite contractions of the neck and larynx, producing successively sphagiasmus and laryngismus, which in turn produce sufficient pressure and excitement of the brain and medulla oblongata by impeding the return of blood from the head, to cause either simple loss of consciousness, or simple convulsion, or convulsion and apoplexy.

That venous congestion of the head and partial asphyxia are caused by the convulsive actions in epilepsy and the true puerperal disease, none can doubt who have watched the phenomena of these affections. But it has been objected by Dr. Watson and others, that the explanation is scarcely applicable in epileptics to the *petit mal*, where the entire seizure consists of a transient but complete loss of consciousness without convulsion. The same may be said of the incomplete seizure in the puerperal state. It sometimes happens, that when the causes of puerperal convulsions are in operation patients are suddenly seized with loss of consciousness, or they are affected with mortal faintness, and die instantly, without any convulsion. In the latter case, as Dr. M. Hall has remarked to me, it must be the heart which is affected, and not the brain, as even the removal of the brain would not extinguish life so immediately as it is destroyed in these cases; and we know that the beat of the heart is interrupted both at the onset of epilepsy and the puerperal convulsion. In the former case, the brain is the organ chiefly affected, and loss of sensation the only phenomenon which appears, the motor function of the spinal marrow being comparatively undisturbed. Thus it would seem that the same causes which affect simultaneously the motion of the heart, the consciousness of the brain, and the action of the muscles under the influence of the spinal marrow, so as to produce the complete group of phenomena constituting the puerperal convulsion, may, instead of exciting the convulsion through the agency of the spinal marrow, produce their effects on the heart or on the cerebrum separately, and so cause either loss of consciousness and volition, or arrest of the action of the heart. There are some normal excito-motor acts in which sensation is also powerfully affected; the relation between the act of coïtus and the cerebral portion of the epileptic attack has often been reverted to since the time of Hippocrates.

In thus attempting to set a limit to the influence of the brain in convulsive diseases, I do not mean to deny that effusion of blood or serum, or vascular congestion of the brain, particularly in the propulsive stage of labour, may occasionally cause puerperal convulsion, but such instances are not frequent enough to justify the general theory. Further, even when convulsions are thus caused, it is not the *Brain*, but the *Spinal Marrow*, which is affected so as to produce them. Mere irritation of the brain, as we have seen, will not cause convulsion, but mechanical or vascular pressure on the brain, so as to affect the medulla oblongata by counter-pressure, immediately brings on an attack. Thus, take two experiments on dogs, performed by Dr. M. Hall and Dr. Blundell; in one, mere injury of the brain produced no effect, but pressure so as to affect the medulla, caused convulsions; in the other, pressure, occasioned by tying the aorta beyond the origin of the carotids, had the same effect as direct cerebral pressure in producing convulsions. In this manner, we must recognise fulness of the cerebral vessels, whether primary, or the result of muscular action, as a cause of puerperal convulsion.

There is, and I repeat it, this remarkable peculiarity about puerperal convulsion. The convulsion itself may in some cases produce that state of the brain which is the cause of the disease in other cases. Thus, there may be cerebral congestion in the first instance, and a fit of convulsion from the intra-cranial pressure upon the medulla oblongata; or there may be a fit excited by uterine or gastric irritation, which will produce a congested state of the brain similar to that which existed in the first instance as a cause of the convulsive disease. Or, to put the matter still more strongly:—During the excessive exertions of the propulsive stage of labour, when ecchymosis in the conjunctiva is not uncommon, a vessel gives way in the brain, producing, in rapid succession, effusion, and convulsion as a result of intra-cranial pressure. Here the coagulum is the *cause of* the convulsion. Again, irritation of the os uteri during its dilatation may excite convulsion, and during a fit, the cerebral vessel shall give way, from the violence of the attack itself. Here the coagulum is *caused by* the convulsion. If a post-mortem examination were made, the same morbid appearances would be found in both these cases, but their interpretations should be widely different. This peculiarity has, without doubt, contributed greatly to obscure our knowledge of the pathology of puerperal convulsion.

In the preceding quotations and observations, I think I have shown that puerperal convulsion has been almost universally referred by obstetric authorities to the cerebrum, and that this cerebral pathology has been of the most vague and unsatisfactory character. Nothing like a successful attempt has ever been made to define the order in which the several causes operate. Predisposing and exciting causes, uterine irritation, mental emotion, impediments to the circulation, apoplectic effusion, determination of blood to the head, (as it is termed,) intemperance in diet, previous epilepsy, have been heaped together, without any very distinct meaning, all, however, being held to be subordinate to a morbid state of the brain. As a consequence of this, the same confusion has reigned in the therapeutics of the malady. I believe I have shown that we must *not* look to the cerebrum for the chief part of the pathology of puerperal convulsion; and I have pointed out some of the sources of the pathological errors which have prevailed; in doing this, I have endeavoured to discriminate between those cases in which the brain is affected as a *cause*, and those in which its pathological condition is the *effect* of the convulsion. In the next Lecture, I propose to give some account of the causes of this malady, grouping them round the reflex function, instead of the phenomena of cerebral disturbance; and I hope to be able to demonstrate that the *cases* of obstetric writers abundantly disprove the common cerebral speculation. I believe it will only be necessary to place their practice in juxtaposition with their hypothesis, to overturn the latter; the clinic will destroy the theory.

LECTURE XXI.

CENTRIC CAUSES OF PUERPERAL CONVULSION. CEREBRAL COUNTER-PRESSURE. IRRITATION OF THE SPINAL CENTRE. STATES OF THE BLOOD. EMOTION. ATMOSPHERIC INFLUENCES. ECCENTRIC CAUSES OF CONVULSION. IRRITATION OF THE UTERUS. IRRITATION OF INTRA-CRANIAL EXCITOR NERVES. IRRITATION OF THE OVARIA. IRRITATION OF THE BOWELS. IRRITATION OF THE STOMACH. IRRITATION OF THE BLADDER, &C. SUMMARY OF CAUSES.

Convulsion, like the other disorders of parturition arising from excessive nervi-motor action, may be divided into those of centric and those of eccentric origin. This division is the most convenient for an investigation of the causes of the disease.

CENTRIC OR DIRECT CAUSES OF PUERPERAL CONVULSION.

Any mechanical or emotional stimulus applied in excess to the spinal centre itself, may excite convulsion during the puerperal state. In all women the excitement of the nervous system inseparable from parturition is a predisposing cause of the attack, which is provoked whenever any other sufficient exciting cause supervenes upon this parturient excitability.

The centric causes of convulsion may be either intra-cranial or intra-vertebral, or both. I proceed to speak first of the intra-cerebral causes.

A clot of blood, or serous effusion, occurring in any part of the brain, may cause convulsion by mechanical counter-pressure upon the medulla oblongata. In full states of the circulation, convulsion may be caused by cerebral distention alone. Here it must be the counter-pressure on the medulla oblongata which, in part at least, produces the disease. Any disease of the brain, of the membranes, or of the skull, capable of exerting internal pressure, may cause convulsion in this manner.

The intra-vertebral causes of convulsion consist chiefly of disorders of the spinal meninges, and upon conditions affecting the substance of the spinal centre itself. Probably excessive distention of this organ with blood excites convulsion; it is certain that the opposite condition, spinal anæmia, becomes a powerful exciting cause. In cases of irremediable uterine hæmorrhage, convulsion is the common form by which death occurs; or a convulsion may occur from loss of blood before the patient is *in extremis*. I shall, moreover, endeavour to show hereafter, that in some cases of convulsion arising from other causes, excessive bloodletting comes in at length as a cause of the fits, the therapeutics of the disease trenching distinctly upon its pathology. In animals killed by bloodletting, either in experiments or at the shambles, convulsion always occurs during the act of dying.

The state of the blood circulating in the spinal centre, as regards its constitution, is an important cause of centric convulsion. All agencies which interfere with the proper depuration of this fluid during pregnancy, or on the approach of parturition, contribute to render the blood a morbid stimulant to the spinal system. Such are the constipation and insufficient secretion from the bowels caused by the mechanical pressure of the gravid uterus upon the intestines. The albuminuria, sometimes present, and which also appears to be caused by pressure on the kidneys and the renal vessels and nerves, accumulates noxious elements in the blood. The encroachment of the abdomen upon the thorax must also render the due oxygenation of the blood difficult. Asphyxia invariably produces convulsions, and when it occurs during parturition, must produce this disease. The act of abortion from asphyxia seems to be almost a part of the general convulsion excited by the deprivation of oxygen. In criminals and others who die by hanging, convulsion is observed. In the reports of suicides and executions, these convulsive actions are termed struggles, and are supposed to involve consciousness and suffering, during the dying moments, whereas they are purely physical, and excited centrically, by the state of asphyxia. In the asphyxia of drowning, the same convulsive actions are present. I mention these facts, as, though not strictly relevant, they illustrate the effects of partial or entire asphyxia in parturition. There are various other sources of sanguineous impurity, all of which contribute their quota towards rendering the blood morbidly irritating to the nervous centres. It deserves to be borne in mind that the depuratory functions ought, in order to preserve health, to be increased during gestation, as the *débris* of the fœtal, as well as the maternal system, have to be eliminated by the organs of the mother. Besides these forms of toxæmia, the state of the blood which obtains in fevers, or during the excitement of the first secretion of milk, may excite convulsive disorder. In all these cases the affection of the nervous system is centric, and not reflex.

There are various predisposing causes of puerperal convulsion, external to the patient herself, which deserve consideration. It has been found that certain states of the atmosphere increase the tendency to this disease. There seems, in fact, to arise at certain times a convulsive constitution of the atmosphere, so that this disease is more frequent than at others. The same has been observed of many spasmodic diseases—tetanus, laryngismus, pertussis, spasmodic asthma, chorea, are all aggravated or relieved by variations of wind, temperature, and other atmospheric changes. The atmospheric epidemical influences must be distinguished from those depending on emotion; it is found that within certain circles, convulsions are common from the influence of fear. One patient suffering from convulsion, her pregnant friends are rendered timid, and consequently predisposed to this affection.

These are all *physical* causes of disease; but there is another and very effective cause of puerperal convulsion which is *psychical* in its character. I refer to the influence of Emotion.

Emotion, then, is a very important cause of centric convulsion in the puerperal state; important both on account of the severity of the attack when thus induced, the greater absence of premonitory signs, and the obstinacy of the disease as regards treatment. It is a very old and true observation, that convulsion is often met with in single women whose minds have been depressed by the sense of shame and misery inseparable from their condition during gestation. But any violent emotion of the mind, whether of joy or sorrow, the agreeable or disagreeable, may excite a convulsive attack. The return of a husband, the first sight of the infant after the hours of intense expectation, the pain and dread of parturition, or any intelligence whatever, suddenly communicated, may hurl the patient into convulsion. I myself recently saw a case in which a husband returning from a distant and perilous journey a day or two after his wife's delivery, in the very act of greeting him she fell into convulsion; and instead of embracing a conscious mother, he held the rigid form of an epileptic. The fit is sometimes produced by emotional causes of a trivial character. Mauriceau related a very singular case in which puerperal convulsion was excited by the disgust caused in the mind of a patient by the entrance into her apartment of a coxcombical friend, whose dress was powerfully scented. The following case from Dr. Merriman's Synopsis, which is most graphically related, illustrates the danger and severity of the emotional form of convulsion more strikingly than any other with which I am acquainted.

Case 1.—" My uncle, the late Dr. Merriman, was one day sent for in great haste, to one of the villages in the neighbourhood of London; on his arrival at the house of the patient to whom he was called, he found her undelivered, and quite dead. At the moment, little information as to the cause of her death could be obtained: but some time afterwards the following particulars were communicated to him.

" The woman had been servant to a lady who was Dr. Merriman's patient, and left her to marry a man, in business as a poulterer. She soon became pregnant, and made up her mind to be attended by the doctor she had been in the habit of seeing at her former mistress's labours. But when she mentioned this her intention to her husband, he objected to it; alleging that Dr. Merriman would not attend her at such a distance unless he received a larger fee than it would be prudent in them to pay; and that there was living in their own neighbourhood a most respectable apothecary, who was a customer; and who, on that and other accounts, was a more proper person to be employed.

" A great deal of unpleasant altercation took place between the husband and wife upon this subject, and was frequently renewed, and the relations of both parties were appealed to on the occasion; all, or the majority, of whom thought the husband right in maintaining his opinion, and censured the wife as pertinacious and self-willed; so that she felt herself compelled, though very reluctantly, to give way; and the gentleman in question, who of course knew nothing of these family disputes, was engaged to attend her, notwithstanding her constant declaration, that 'she hated the very sight of him.'

"When the first symptoms of labour came on, and her nurse and some female friends were assembled, it was proposed that her accoucheur should likewise be sent for; but she begged that he might not, as she was sure she was not bad enough yet. After a time it was again proposed to send for him, but she still objected. Again and again her friends tried to prevail upon her to see him, but all in vain: if it had been her own doctor, as she termed it, she would willingly, she said, see him; but as it was, Mr. J—— should not come near her till he was really wanted.

"At length, one of the women in the room, disgusted with so much obstinacy, went down stairs, and told the husband that the presence of her medical attendant was absolutely required, and accordingly he was immediately sent for.

"Unfortunately, and certainly very inconsiderately, he was, on his arrival, without being announced, introduced at once into her room. The shock of thus suddenly and unexpectedly seeing the man, against whom she had been long nourishing such a perverse dislike, occasioned her to scream out, and she fell back upon the bed in a fit, from which she never recovered. In the confusion which ensued, a messenger was sent in great haste to London for Dr. Merriman; but, as already stated, before he arrived at the house, the woman was quite dead.

"No attempt had been made to extract the child, nor could leave be obtained to open the body; so that the immediate cause of her death was never discovered; but that the sudden emotion was the exciting cause, seems unquestionable."

The anatomical mechanism by which emotion produces convulsion is not understood. An attempt has been made to call movements resulting from impressions on the nerves of special sense and the emotions they excite, reflex cerebral movements. But movements of this kind are clearly different altogether from the reflex physical movements; they may arise from the memory as well as from sensual impressions. It would be introducing confusion to apply to them the term reflex. We know that emotional movements may occur in limbs paralyzed to voluntary motion. Therefore, the mechanism of emotional movements and emotional convulsion can hardly be the same as the mechanism of voluntary motion. That the mechanism of puerperal convulsion is spinal and not cerebral is evident, because the fit may occur during apoplexy with perfect loss of voluntary motion. But it is still a great mystery how emotion and psychical and cerebral functions, should affect the great physical organ of motor action. Here we have a chasm which we cannot bridge—at which the human intellect recoils—the separation between the physical and the psychical, body and soul, in the living economy.

Such being the principal *Centric* causes of puerperal convulsions, let us now consider the *Eccentric*, or those caused by irritation of incident, excitor, nerves, acting through them upon the spinal marrow, and its motor nerves.

MEDICA SOCIE

ECCENTRIC OR REFLEX CAUSES OF PUERPERAL CONVULSIONS.

First in importance is, *Convulsion from Irritation of the Uterus itself and the Uterine Passages.*

The statistics of labour demonstrate that puerperal convulsions occur with far greater relative frequency when the head presents, than in other presentations. From this it has been inferred that the pressure on the os uteri was a principal cause; but the acute mind of Dr. Collins saw that this coincidence could not be considered as cause and effect, for convulsions frequently come on when the os uteri is entirely dilated, before the dilatation has commenced, or after delivery. Neither this eminent obstetrician nor any other has taken the pressure of the head on the vagina sufficiently into consideration, in connexion with the fact, that irritation of the vagina excites more extensive reflex muscular actions than irritation of the uterus itself. This gives a physiological explanation to the fact respecting the frequency of convulsions in head-presentations with first children, the irritation of the excitor nerves of the os uteri and the vagina being undoubtedly greater under such circumstances than any other. I might adduce numbers of cases in support of this view; in fact, any case in which all remedies have been tried in vain, but in which the convulsions cease immediately after delivery, contains its proof. It must always be borne in mind, when considering the causes of excito-motor diseases, that *irritation* of the peripheral incident nerves is not dependent on, or to be measured by, the mere intensity of pain. It has been shown again and again that the most powerful reflex action of the *vis nervosa* may be caused without any sensation whatever; indeed, in puerperal convulsions the causes operate sometimes during a state of perfect coma, or they may commence while the patient is in a profound syncope. The term irritation, when applied to spinal action, must therefore, as I have often observed, be received with its peculiar signification.

Convulsions may be brought on by the mere presence of the fœtus in utero, there being no other exciting cause; or they may occur from the causes of spinal irritation depending on the first changes which take place in the uterine system preparatory to labour, before the os uteri has commenced its dilatation. They are sometimes caused by the irritation of a dead fœtus, which it is well known is more strongly excitor of reflex action than a living ovum. The mere distention of the uterus by the liquor amnii, particularly in cases where there is a large quantity of this fluid, has appeared to give rise to convulsions.

When a convulsion has once happened, the fit may be repeated from causes of uterine irritation apparently trivial. Irritation of the os uteri is one of these. Denman relates the following, of a case which occurred to him:—"When the os internum began to dilate, I gently assisted during every pain; but being soon convinced that this endeavour brought on, continued, or increased the convulsions, I desisted, and left the work to Nature." A similar case was once related to me by Dr. Heming. In other cases, fits have been produced by the hand of the accoucheur in the operation of turning, or by the irritation caused by the use of instruments. Irritation of the os externum is also a powerful excitor of spasmodic action. Many women die from the violence of the convulsion caused by the passage of the child through the external parts. On another occasion I shall have to relate a case in which successive fits were caused by irritation of the uterus from injudicious attempts to apply an abdominal bandage.

The following are two interesting cases of puerperal convulsions from irritation or excitation of the excitor nerves of the uterus and uterine passages, the irritation being conveyed to the spinal marrow and reflected back on the motor nerves of the whole spinal system, so as to cause the convulsions. The first is related by Dr. Ingleby:—

Case 2.—"A highly esteemed friend of mine once found it necessary to pass his hand into the uterus, for the purpose of removing an adherent placenta, the ergot of rye having been previously administered. The introduction was carefully performed. *The straining and opposition to his efforts on the part of the woman were exceedingly great; and at the moment when the operator's hand had reached the organ, my own hand making counter-pressure on the abdomen,* the patient became violently convulsed, and died in less than a minute."

The second is from Dr. F. H. Ramsbotham, who relates a case of convulsions in which the fits were relieved by bleeding, and the woman remained fifty hours after the attack, before labour came on. In less than five hours she was delivered without any recurrence of the fits; but as the placenta did not come away, Dr. Ramsbotham was summoned, two hours after the expulsion of the child. He remarks that, "Under no greater anxiety than usual when the placenta is retained, I proceeded in the ordinary way to remove it. *The moment I had passed my hand completely into the uterine cavity,* the patient turned upon her abdomen, and without uttering any expression of pain, went into a convulsion." The woman died in about two hours.

Convulsion from Irritation of Intra-Cranial Excitor Nerves.

It may appear a nice distinction to classify convulsion arising from cerebral pressure on the medulla oblongata, and convulsion caused by irritation of the membranes, under different heads. Yet the one is centric, the other eccentric.

Cerebral pressure affects the medulla oblongata directly, m ningeal irritation reaches it reflexly, so that some distinction really demanded. The known intra-cranial causes of puerper convulsion of a reflex character are, bony spiculi, inflammatio of the meninges, the extension of red softening of the brain t the membranes, or the extension of irritation from a coagulu in the substance of the brain. Thus, in puerperal convulsio we have to study the brain and its envelopes under many an very important points of view; 1, as the seat of some of th most important changes which occur during the fit; 2, as th seat of an important class of centric causes of convulsion; an 3, as the source of irritation acting upon the spinal centre i reflex forms. As a reflex cause of convulsion we must stud the brain as we would the uterus, the stomach, the intestines, &c.

Convulsion from Irritation of the Ovaria.

Every practitioner must have observed cases of epilepsy depending upon the periodical return of ovarian irritation at th times of the catamenia. This form of epilepsy is very common Some female epileptics suffer from an attack at the commencement of each catamenial flow, and at no other time. Others have the fits in greater severity and frequency at each returning period. Such cases prove the influence of the ovaria in exciting convulsion in the female economy. Indeed, during their seasons of activity the ovaria are the paramount source of all convulsive affections. Possibly this may be the reason why some epileptics are, in great measure, free from convulsion during pregnancy, the ovaria being at this time in a state of comparative quietude. I have shown that at parturition the ovarian irritation recurs, and I have no doubt that it is now a frequent cause of puerperal convulsion and puerperal mania. The connexion between puerperal mania and ovarian irritation is often seen in cases of mania of an erotic type. In puerperal convulsion, the ovarian irritation of parturition is probably an assisting cause in all cases, and in some cases the chief cause. By far the majority of cases occur within the time of the lochial period, that is, between the first sanguineous discharge, or "show," and the time of the disappearance of the sanguineous lochia.

Convulsion from Irritation of the Intestinal Canal.

Irritation of the bowels, especially of the lower part of the ntestinal canal, is well known to cause convulsion under other ircumstances besides those connected with the puerperal tate. Thus worms, the severe action of purgative medicines, he collection of indurated fæces in the bowel, have all been nown to cause epilepsy, and the convulsions of children. It annot therefore be wondered at, that when the excito-motor ystem is under the additional stimulus of either pregnancy, abour, or the puerperal state, these and similar sources of xcitation should cause puerperal convulsions. I subjoin two ases, the second of which is particularly instructive, and the uthor of it relates several others bearing equally strong upon his point. The first case is by Dr. R. Lee.

Case 3.—"Mrs. H——, aged twenty-four; first pregnancy, inth month. *Constipation and headach for several days;* severe its of convulsion, insensible in the intervals; pupils dilated; ulse eighty, full and strong; face flushed; os uteri slightly ilated; feeble, irregular, uterine pains. After venesection nd *free evacuation of the bowels*, the fits ceased, and she was elivered the next day, without assistance, of a living child."—r. R. Lee, "Clinical Midwifery."

The next is a case of the late Dr. Ingleby's:—

Case 4.—"Elizabeth Roden, aged twenty-three, had become ery plethoric during the latter months of pregnancy, but, ith the exception of drowsiness, had not experienced any of he premonitory symptoms of convulsion. She was delivered, t six P.M., June 25th, of her first child, after a very natural nd easy labour, and at nine was seized with a violent convulion, which lasted ten minutes. Mr. Bindley saw her at halfast eleven; the fits had recurred several times; she was now artially sensible, but the stupor was considerable; presently, he paroxysm returned; she rolled her head about, struggled, aliva issued from the mouth; the pulse was full but not freuent, the head hot, and the face flushed, the lochiæ sparing, nd the bowels constipated. Mr. Bindley ordered leeches, old to the head, and camphor and opium.

"26th, Eight A.M.—The fits have frequently recurred during he night. In the intervals between the attacks she lies in a state of coma, and has stertorous respiration. V. S. to ℥xxv; head to be shaved, and cold cloths applied. Calomel, jalap, and the purging mixture, were ordered.—Two P.M. The convulsions continue; the teeth had become so firmly fixed, that it was found impracticable to give her the medicine; pulse 100. The blood does not present an inflammatory crust. Cold to be continued.—Seven P.M. The convulsions have recurred. ℞ Croton oil, eight minims; spirits of wine, ʒij; cinnamon water, ℥ij. A drachm every three hours, until the bowels are moved.

"29th, Eight A.M.—*A surprising quantity of dark green and very offensive fæculent matter has been discharged, including a multitude of ascarides.* She now became sensible, but was unconscious of her illness, and did not remember having been delivered. From this time, with very slight deviations, she gradually and completely recovered."

Convulsion from Irritation of the Stomach.

Gastric irritation has long been looked on as a cause of puerperal convulsions, though the true rationale has never been given by obstetric writers. I subjoin two cases. Of the nature of the first I believe there can be no doubt, and in the second, the evidence of a loaded state of the stomach, coupled with the fact, that neither venesection, evacuation of the bowels, nor careful delivery, afforded any relief, are sufficient reasons for considering it a case in point.

CASE 5.—"Mrs. H., a young woman, of a very healthy constitution, had passed through the period of childbirth very well on former occasions, as well as on that which preceded the present subject of consideration. She had been delivered of her child nearly a month, and had ceased to require any medical attendance. She had entirely left the chamber in which she had been confined, and had returned to her ordinary modes of life.

"On waking one morning she complained of pain in her head, but it was not sufficiently violent to confine her to her room; she therefore went into the drawing-room, where she was left in the afternoon, with one of her children.

"Her husband was in a room underneath, and having heard something fall upon the floor with great violence, he had concluded that the child had fallen on the ground, but on opening the door he saw his wife lying on the ground, senseless, convulsed, snorting, and foaming at the mouth. He immediately sent in great haste to the writer. When he arrived, the convulsion had ceased, but she was lying in a comatose state. Bleeding from the orifice of a large vein, purging, blistering, and low living, at length succeeded in removing the pressing symptoms, and she at length recovered, but for a long time she continued to be liable to pains in the head.

"On investigating the cause of this attack, it appeared that *on the day before, she had indulged in eating oysters.* She had in all other points adhered to a very simple and regular diet, and no other circumstance had occurred to which the disease could have been attributed.

"The conclusion to be drawn from the consideration of the cases which have been related above [six similar cases are detailed] is, that the state of pregnancy not only induces such a flow of blood to the head as to dispose it to be violently affected by the strong exertions of labour, so as to induce puerperal convulsions, but also to render it liable to be particularly acted upon for some time after childbirth, by sympathy with the stomach, *when indigestible substances, especially the fishes of the bivalvæ class, have been eaten.*"—DR. JOHN CLARKE, in the fifth volume of "Transactions of the College of Physicians."

CASE 6.—"Mrs. P., aged twenty-six, first pregnancy, full period; returned home after midnight from a large dinner-party, at which she *had partaken of a variety of dishes and wines*, and had been seated near a large fire. Labour came on at four A.M., and soon after she became incoherent, and said she felt her teeth falling out of her head. On attempting to drink some warm tea she bit a large piece from the edge of the china cup, and crushed it between her teeth. Convulsions of great violence immediately followed. Copious venesection and an enema gave no relief. In an hour and a half the head of the child was within reach of the forceps, and it was applied, and the child was extracted alive. She died at eleven A.M."—DR. LEE, "Clinical Midwifery."

Convulsion from Irritation of the Bladder.

Irritation of the bladder is a less frequent, though undoubted, cause of puerperal convulsions. The following is an interesting case, which occurred more than a century and a half ago, in the practice of La Motte :

Case 7.—" Le 18 Mars de l'année 1695, la femme d'une personne de cette ville, me fit prier de l'aller voir. Elle étoit reduite à l'extrémité, par un accident des plus fâcheux, qu'elle soufroit depuis plusieurs mois. J'y allai promptement, et je trouvai cette pauvre femme avec une douleur dans le bas ventre, non des plus vives, mais continuelle, accompagnée de mouvemens convulsifs et souvent de convulsions assez violentes, pour faire craindre un accouchement prématuré. Elle étoit dans le settiéme mois de sa grossesse; ce que j'eus peine à croire en ce qu'elle ne me paraissoit pas seulement grosse à terme et pour accoucheur d'un jour à l'autre, mais assez pour me persuader qu'elle l'étoit de deux enfans, tant son ventre avoit de volume en toutes ses dimensions, avec beaucoup de peine à marcher, et des envies continuelles d'uriner, sans le pouvoir faire, que très peu et goutte à goutte.

" Après avoir réfléchi sur tous ces accidens, je fis coucher cette femme sur un paillasse devant le feu, en la même situation que pour l'accoucher; après quoi ayant voulu introduire ma sonde dans l'uretre, j'y trouvai de la résistance. Je trempai mon doight dans l'huile, que je coulai dans le vagin; je trouvai la tête de l'enfant, qui comprimoit le cou de la vessie, qui interceptoit presque entièrement le cours de l'urine. Je la repoussai doucement le plus haut qu'il me fut possible. Dès le moment que le cou de la vessie se trouva dégagé et que l'urine eut son issue libre il en sortit une telle quantité qu'il n'est pas possible de croire que la vessie fût capable d'en contenir autant, ni de se dilater jusqu'à un tel excès, sans se rompre. La malade se trouva soulagée sur l'heure, et se porta bien jusqu'à son accouchement."

The next is another case of the variety of vesical convulsions, which was related, with reference to a paper of mine upon this subject, by Mr. Vines, of Reading.

Case 8.—" Susan C——, aged twenty, of spare habit and nervous temperament, had enjoyed tolerably good health, and was about eight months advanced in her first pregnancy, when she was suddenly seized with convulsions on Friday, 11th of October, 1844. The medical man first in attendance bled from the arm to sixteen ounces, and ordered aperient medicine. On the following day, ten A.M., when I first saw the patient, her symptoms were as follow:—The face and whole surface of the body livid, features distorted, frothy mucus about the mouth, œdema of the upper extremities, frequent and violent convulsions, requiring two or three persons to hold her, perfect unconsciousness; there was also inordinate and tumultuous action of the heart, with a quick, feeble, and fluttering pulse.

"*Treatment.*—Cold water repeatedly dashed on the face and neck; warm applications to the extremities; half a grain of the acetate of morphia to be taken directly; a mixture of sulphuric ether with camphor julep every four hours. At four P.M. the child was expelled from the uterus, the mother being perfectly unconscious of the circumstance—an interesting physiological fact.

"October 13th.—The patient's general appearance improved; still, however, unconscious, and occasionally convulsed. Applies her hands to the head, which feels extremely hot. The hair to be removed; leeches applied to the temples, and afterwards wet rags; continue the medicines.—Eight P.M. Patient very restless, heat of head diminished, but unconsciousness still continues. *Finding, upon examination, the lower part of the abdomen enormously distended, I was led to suspect retention of urine. A catheter was at once passed, and five and a half pints of turbid urine, having a strong ammoniacal odour, drawn off.* The removal of the water was followed by great improvement of all the symptoms, and on the return of consciousness the patient expressed herself surprised on being told of what had happened. To take eight grains of Dover's powder at bedtime.

"14th.—Has passed a good night; general appearance of patient better; has had no return of the convulsions since the evacuation of the bladder; is troubled, however, with cough, and complains of tenderness of the chest. To take a saline with ipecacuanha wine and tincture of hyoscyamus. The catheter to be used morning and evening. Repeat the Dover's powder at bedtime.

"15th.—Has slept tolerably well; makes no complaint of pain; the bowels confined. There is still retention of urine, caused probably by the great distention of the bladder on the previous days. To take an aperient, continue the cough medicine, and the use of the catheter.

"The after-treatment of this patient consisted in the administration of gentle tonics, mild aperients, and the use of the catheter; turpentine liniment applied over the loins and pubic region. The bladder was remarkably slow in recovering its action, and the urine retained for a considerable time its turbid appearance and disagreeable odour. The infusion of buchu was given with decided advantage."

Irritation of the kidney has been known to excite epilepsy, and most probably it would act as a cause of puerperal convulsion: La Motte and others have recorded cases of this kind. It is an old remark, that œdema of the face and neck forms a frequent premonitory sign of the attack; and Dr. Lever has made the interesting and important observation that albuminuria is present in many instances. These points require further examination, with special reference to the different modes in which spinal action may be excited.

Other causes than those which have been given, occasionally operate on the spinal system, but all act in accordance with the principles already advanced. Professor Ingleby suspected that irritation of the Mammæ might cause convulsions. Not long since, I saw a case of puerperal convulsion for which no other cause could be assigned than excessive soreness of the nipple, with mammary induration. The Skin, too, as an important excito-motor organ, must be studied in relation to puerperal convulsions. The same may be said of the Liver, and other organs supplied by the pneumogastric nerve.

Such are the principal causes of puerperal convulsions, to the *modus agendi* of all of which the physiology of the true spinal marrow supplies as full and perfect an explanation as we have of the causes of any disease whatsoever; and it must be remembered, that wanting this mode of solution, the whole disease formed, confessedly, one of the profoundest enigmas of pathology.

In conclusion, to give a summary of the whole subject, the true puerperal convulsion can only occur when the central organ of this system—*the Spinal Marrow*, has been acted on by an excited condition of an important class of its incident nerves—namely, those passing from the uterine organs to the spinal centre, such excitement depending on pregnancy, labour, or the puerperal state. While the spinal marrow remains under the influence of either of these stimuli, convulsions may arise from two series of causes—those acting primarily on the spinal marrow, or *centric* causes, and, secondly, those affecting the extremities of its incident nerves —causes of *eccentric* or peripheral origin.

I. Causes acting immediately on the Central Organ:—

1. Pressure exerted on the medulla oblongata by congestion, coagula, serous effusion within the cranium, &c.
2. Loss of blood.
3. Morbid elements in the blood.
4. The influence of emotion.

II. Causes acting on the extremities of Excitor Nerves:—

1. Irritation of the incident spinal nerves of the uterus and uterine passages.
2. Irritation of excitor nerves within the cranium.
3. Irritation of the incident spinal nerves of the rectum.
4. Irritation of the ovarian nerves.
5. Irritation of the gastric and intestinal branches of the pneumogastric nerve.
6. Irritation of the incident spinal nerves of the bladder.
7. As probable causes, may be enumerated, irritation of the cutaneous nerves, of the nerves of the mammæ, and of the hepatic and renal branches of the pneumogastric.

Though the subject distinctly admits of this division, several causes may act together, and centric and eccentric causes may be in operation at the same time. I have made no attempt at a division into predisposing and exciting, proximate and remote causes, as other authors have usually done, because it is evident that a cause which in one case is the exciting or proximate, may in another be the predisposing or remote cause. Thus, irritation of the uterus may be the predisposing, and irritation of the stomach the exciting cause, in one instance, while in another, irritation of the uterus is both the predisposing and the exciting cause; hence any such division must be, to a great extent, arbitrary, and devoid of precise meaning. For instance: Dr. Ramsbotham, in a passage I have quoted, says, "The most usual *proximate cause* of puerperal convulsion is probably pressure on the brain," whereas it can be shown that cerebral pressure is usually a symptom produced by some *exciting cause* previously in operation. The same authority mentions irritation of the stomach and intestines among the *remote causes*, though there can be no doubt of their being generally exciting causes when they exist as causes of any kind. It would be easy to lengthen the series of cases I have selected to illustrate my views, but what I have chiefly desired to do has been to place the clinic of obstetric writers in opposition to their hypotheses. I think the cases now adduced are of themselves sufficient to overturn the theoretic opinions quoted in the last lecture.

The views of the nature and causes of puerperal convulsions, developed in the present lecture, are, as I believe, capable of important practical application in the treatment and prevention of the disease. This branch of the subject I propose to consider hereafter; but in the next lecture I shall endeavour to describe the actual phenomena of puerperal convulsion. I shall attempt to show *how* the various causes operate in producing the fit.

LECTURE XXII.

PHYSIOLOGY OF SLEEP. CONVULSIVE ERETHISMUS; SPHAGIASMUS; LARYNGISMUS; ODAXISMUS; PHARYNGISMUS; CARDIASMUS. THE CONVULSIVE PAROXYSM. RELATION OF CONVULSIVE ACTION TO LABOUR-PAINS. RELATION OF PUERPERAL CONVULSION TO EPILEPSY, PUERPERAL MANIA, APOPLEXY, AND CEREBRAL SYNCOPE, &c.

Having discussed the causes of puerperal convulsion, let us turn to the study of the successive actions which these causes call forth; in other words, let us endeavour to obtain some account of the phenomena which coustitute the fully-formed attack. There are a multitude of points worthy of attention, occurring between the eccentric or centric irritation which makes little or no sign, and the terrific struggle of the fit itself.

And, first, I would express the highest admiration of the singular power with which Dr. Marshall Hall has himself applied the reflex function to the convulsions of infancy, epilepsy in the adult, and apoplectic affections, in the series of papers which first appeared in The Lancet, and which were afterwards printed for private circulation. These essays are the most perfect compositions which have ever issued from the mind of their author, and in my opinion, they constitute a new step in the application of spinal physiology to practical medicine. Dr. M. Hall has not himself yet treated of puerperal convulsion in the same method as he has treated the epileptic form, and the infantile malady, though he has expressed his intention of so doing at a future opportunity In the meantime I venture to take up this important subject, with the hope that it may not suffer in my hands, until Dr. M. Hall shall fulfil his intention.

In his large work on the "Nervous System," Dr. M. Hall has referred to the stiffness of the muscles of the neck and the laryngismus of epilepsy, as important means in effecting the unconsciousness and the cerebral fulness of epilepsy. In the second volume of his "Observations and Suggestions," he first, I believe, broached the theory that cervical contractions produces sleep. In the "Essays" on the theory of convulsive diseases, great prominence is given to the reflex contractions of the cervical muscles and the consequent compression of the veins and impediment to the return of venous blood from the cerebrum, in causing the fully-developed phenomena of convulsion. I propose to extend these views to puerperal convulsion, preserving, at the same time, an independence or difference of opinion on some important points.

According to Dr. M. Hall's opinion, on the suspension of volition, the platysma myoides, and perhaps the other muscles of the neck, contract upon the jugular and other veins so as to compress them gently, and produce slight cerebral fulness, and it is this which predisposes to, and produces, sleep. He compares the contraction of the platysma on the withdrawal of volition, to the contraction of the orbicularis palpebrarum from the same cause. It has seemed to me that the orbicularis muscle is itself concerned with the platysma in the production of sleep. The dilatation of the orbicularis cannot be the mere result of the contraction of the levator palpebræ, and the influence of volition; it must be an active and involuntary state, and I have little doubt that the impression of light upon the retina is an exciting cause of this reflex dilatation. The action of light on the irides is evident; and if what I have said be correct, we have the same excitor, the branches of the third nerve distributed to the retina, and susceptible to the impression of light, (just as the pneumogastric in the lungs is to carbonic acid,) producing two distinct reflex actions, one the due contraction of the iris, the other the due dilatation of the orbicularis. Or it may be, that very strong light produces reflex contraction of the orbicularis. In some animals, birds, for instance, the connexion between the absence of the stimulus of light, the closure of the orbicularis, and sleep, is very marked. On the instant almost that light is withdrawn, the orbicularis closes, and sleep begins, so that birds may be put to sleep in the day-time by artificial darkness. It may be objected that certain birds and animals have the orbicularis closed in the day-time, and dilated at night, or are in the same condition by night or day. But in such cases, either there is very great power of modification, as in the case of the cat, or the retina is so sensitive to light, as in the case of the owl, that in strong daylight the eye is closed to avoid pain. It has seemed to me that the pressure on the veins by the orbicularis, and the diminished quantity of blood sent to the structure of the eye during its state of repose, may have some influence upon the cerebral circulation in the human subject.

But this is in the nature of a digression. Taking sleep as caused by some kind of compression of the cervical veins, and slight venous distention of the cerebrum, Dr. M. Hall has based the pathology of convulsion upon this physiological process. The actions of convulsion are, in the first place, merely an excess of the actions which occur nightly during sleep. I need hardly refer to the frequency with which the invasion of epilepsy occurs while the patient is falling asleep, or the frequency with which apoplectic effusions take place during the night-time.

Thus, then, we must, according to his view, look on sleep as an erectile state of the cerebral tissue. The compression of the cervical veins necessarily injects the brain and the medulla oblongata. It was some time ago stated by a physician in Dublin, that the plexus choroides was the organ of sleep. This organ was supposed to become distended during sleep, so as to press upon the cerebral substance. I am not aware whether the mechanism for injecting the plexus physiological was described or not. It is quite possible that cervical pressure might do this, and the structure of this plexus renders its varying vascular fulness a matter of probability. It seems to me also that the *rete mirabile* deserves especial study with reference to the production of sleep, and we must also study the condition of the thyroid body as an important diverticulum of the cerebral circulation.

If we consider the sleep of the brain its erectile condition, we must not hesitate to compare the brain with other erectile organs. Of course I am speaking of a very gentle venous distention, and not one which in extent can be compared with other forms of erectile action. We must compare them with this limitation, that the injection of the cerebral vessels is small when compared with other and more erectile organs in their state of activity. It may seem insane or ridiculous to compare the erection of the penis, the erection of the mammæ at the time of the *draught*, the erection of the nipple, the erection of the cheek, so to speak, in blushing, with the state of the brain in sleep. Yet the same principle is probably involved in all these instances; namely, retardation of the return of venous blood by mechanical means. Muscular action, venous compression, and vascular distention, are the phenomena witnessed in each case, though the extent to which it occurs in different cases has been sufficient to cause their identity to be overlooked. These actions are in all cases involuntary and reflex, though, as in the case of other reflex actions, emotion exerts a powerful influence. In the case of the brain it appears to be the platysma myoides which is chiefly in action; in the mammæ, the dentated fibrous fascia surrounding these glands appears to be concerned; in the case of the penis, the dartos contributes to the tension which accompanies and produces erection. Thus we have several superficial fibrous structures, or panniculate muscles, all contributing to the same kind of function. Other erectile actions in animals may be mentioned as probably depending on a similar cause, such as the pouting of the pigeon, the erection of the wattles of the turkey, or the comb of the cock.

The singular function of hybernation is intimately connected with natural sleep. It may be found that hybernation, like sleep, depends upon venous congestion, within the limits of physiology, and that involuntary muscular contraction is concerned in the long winter-sleep of animals, as in ordinary sleep. In the hedge-hog, for instance, during winter, the *panniculus carnosus* contracts so as to give it the shape of a round ball. May not this motor action have much to do with its prolonged repose?

But it may be asked—What have these points to do with puerperal convulsion? Obviously very much, if it has or can be made at all clear that these functions are in physiology what convulsion, laryngismus, and paroxysmal apoplexy are in pathology. Bacon says, that to perceive remote similarities belongs to one of the highest faculties of the human mind. Remote but true analogies placed by the mind side by side are powerful means of elucidating the most hidden truths. Physiological insight can often apply a simple fact, like a torch, to the illumination of important classes of facts, as yet in obscurity. In the ordinary reflex actions, we find enough to explain the violent convulsive actions of the general muscular system in epilepsy or the puerperal fit, but in that peculiar series of reflex contractions concerned in causing the erectile state of the cerebrum by venous pressure, we seem to approach the mechanism by which the train of convulsive actions are produced.

The premonitory signs of puerperal convulsion are various in different cases. There are generally headach, giddiness, flashings before the eyes, ringings in the ears, intolerance of light, and other signs of disturbance of the cerebral circulation, before the fit occurs. But in some cases the premonition is extremely brief, or the attack is instantaneous. The patient suddenly loses her sight, and falls into the fit, or she sees the fiery circles, which give the name *eclampsia*, before her eyes for a moment, when the convulsion is at once established. Or sudden and transient loss of consciousness may occur several times, before any obvious convulsion sets in. These premonitory symptoms of puerperal convulsion are in reality the symptoms of the particular condition of the spinal nervous system in which convulsions occur; they are the signs of what may be termed the *convulsive erethismus*. Grave disturbance of the spinal system cannot reveal itself in its own sphere except by convulsive action. It appears that disturbance of the spinal centre produces disorder of the cerebrum; and that in this way it is made evident before any convulsive action occurs. But in some cases, it must be borne in mind, the sphagiasmus may produce cerebral symptoms. However, it is undoubted that the convulsive erethismus is often attended by head symptoms before any sphagiasmus or other spasmodic action has occurred. Besides this, the synergic relations between the uterus and the brain are very intimate, and the condition of the uterine organs which sets up the spinal erethismus, sets up an irritable state of the brain, which, though it would not of itself produce convulsion, renders convulsion more dangerous to the cerebrum than it would otherwise prove. This makes the chief difference between the state of the brain in the epileptic and the puerperal attack. Hence arises the tendency to apoplexy, phrenitis, or puerperal mania, after the occurrence of puerperal convulsions. We might say the same of the premonitions of epilepsy, and of the convulsions of children, only that all the premonitory symptoms are usually more intense in puerperal convulsion than in the epileptic seizure. The convulsive erethism and its causes require special study. Our means of preventing convulsion are in reality the means of subduing this erethismal condition.

Spasm and convulsion never occur but in special conditions of the spinal system. The scalpel gives us nerves. Experiment and observation reveal the function of these nerves in connexion with the spinal centre. We know that the physical stimuli supplied to the peripheral extremities of the excitor portions of the reflex nervous arcs, excite the various physiological reflex motor actions of the economy. We know that food excites the reflex movements of deglutition; that the changes of respiration supply the stimuli which excite the reflex movements of respiration; that the fœtus excites the motor actions of parturition. We know, too, much of the laws which regulate these actions. But we do not know the intimate changes which occur in the nervous tissues to effect the phenomena we observe. We see the cause, we witness the effect, we can trace the track by which the effect is produced, and we can imitate Nature, and even excite the various physiological actions artificially, but we know little of the intimate mechanism of nervous action. To pass over from physiology to pathology. We have here the same kind of knowledge, and this knowledge is most powerful to prevent, avert, and relieve the diseases of the spinal system. We see irritation applied to the extremities of excitor nerves, and instead of physiological actions, we behold local spasm, or general convulsion, or paralysis. We can trace with tolerable certainty the laws which produce these morbid actions, but we cannot see in the nerve, or nervous centre, any change which should make us augur in the one case a reflex physiological, in the other, a reflex pathological act. Something is going on either in the nerve, or in the spinal centre, beyond our present comprehension. But to understand that which is, without such knowledge, perfectly intelligible in the production of convulsion, it will be necessary to indicate as nearly as possible the hidden mechanisms which potentially give convulsion to nerve and muscle.

Place the nipple between the gums of the infant, and it excites the movements of suction and deglutition, and nothing more. Let the same gums be irritated continuously by the advancing teeth, and instead of producing at once a reflex action of any kind, the irritation slowly excites the whole of the spinal system to such a pitch of intensity, that every nerve and muscle connected with this system is, after awhile, engaged in successive fits of violent convulsion. Nay, more, the touch even of the surface by a feather is sufficient to invoke an attack, which may in a moment prove fatal. The entire system is, so to speak, loaded or saturated with excitability, which it discharges with terrific danger to life and limb on the slightest provocation. And so long as the alveolar irritation continues, the excitability, or morbid augmentation of the *vis nervosa*, increases; while if the local disorder be removed, the excitability,—the charged state of the spinal centre, diminishes. The fits become less violent and less frequent, and causes which before produced convulsions, either do not produce them at all, or if provoked they are diminished in intensity, until at length the normal condition of excitability is re-established, and excitation, instead of producing spasm, excites only normal reflex action. The level of physiology is reached again.

So in the case of the uterus. The fœtus may be descending through the parturient canal, or the preparations for its descent may be progressing. In one case it may excite only those reflex actions which are proper to the completion of labour. Everything may go on safely and regularly from the commencement to the termination of delivery. But in another case, the natural reflex actions may be arrested, or they may proceed naturally, but over and beyond these actions, the convulsive erethism of the spinal system which terminates in convulsion, may be induced. Now, the irritation which should excite the reflex actions of parturition, excites convulsion; or other irritations besides those concerned in the production of labour, induce the seizure; or, from time to time, without any obvious or special irritation, the augmented motor power overflows from the spinal system to the muscles in the shape of violent fits of convulsion. So far we may describe what actually takes place. These are simply matters of fact, without intermixture of speculation or hypothesis.

Whatever the exciting cause of the convulsion may be in a given case, whether reflex or direct, the state of incubation —the convulsive erethism, must have preceded the fit. It is this augmented excitability which really constitutes the essence of convulsion. There may be two patients, with their various organs, in precisely the same state, so far as our means of diagnosis extend, and the progress of labour the same; the one falls into convulsion, the other proceeds naturally with the parturient function. The only difference is in the erethismal condition induced in the spinal system by the persistent irritation, a difference which we can only see and understand from its effects. We do not know why in the one case the line of physiology should be preserved, while in the other pathology becomes dominant. We know the causes, and we see the effects, of spinal erethismus, but we do not know how it occurs, or in what it essentially consists. When we know as much of the *vis nervosa* as we do of light, heat, or electricity, perhaps this problem may approach its solution, but at present we can only learn its most outward phenomena.

The first motor result of this morbid erethism, and the local irritation to which this itself is attributable, is *Sphagiasmus*, a contraction of the muscles of the neck. In puerperal convulsion, this sphagiasmus takes place to such an extent as considerably to impede the flow of blood from the head. It is to this Dr. M. Hall chiefly refers the insensibility of convulsion. The mechanism of this symptom is a reflex action of the platysma-myoides and the various other muscles of the neck, so as to impede the return of venous blood from the brain and the upper portion of the spinal marrow, by the vertebral and the internal and external jugular veins. It seems to be an excess of the physiological actions which appear to occur in sleep, or blushing. The effects of sphagiasmus are seen in the swollen state of the neck, the turgidity of the superficial veins, and the more or less perfect loss of consciousness and volition. These phenomena may occur separately, or they may merge in, and form part of, the general convulsion.

The next result or symptom is *Laryngismus*, a partial or entire closure of the larynx by spasmodic actions of the laryngeal muscles. There is either total arrest of the respiration, or stridulous expiration, with hasty inspiration, occurs. Of course, as a primary result of laryngismus, the oxygenation of the blood in the lungs is impeded or suspended, and partial or entire asphyxia ensues. Then comes the terrific convulsion of the fully-formed puerperal attack. The head and neck are not only gorged, but they are gorged with black blood, and discoloration, with turgidity of the skin, eyes, and tongue, quickly take place. The tongue, black and swollen almost to erection, is thrust out of the mouth, and the injection of the salivary glands produces a large increase in their secretion. Dr. M. Hall believes that without the laryngismus and the partial asphyxia, with the circulation of venous blood in the brain, and its impeded return from sphagiasmus, true convulsion, with loss of consciousness, could not occur. These reflex clutchings of the neck and the air tubes, in sphagiasmus and laryngismus, are certainly among the most important phenomena of convulsion, whether we consider them as symptoms, or as the causes of the ulterior actions which complete the fit.

The next symptom in time or importance is the *Odaxismus*, or closure of the jaws. The teeth are shut, and owing to the protrusion of the tongue and the swollen state of the cheeks, both tongue and cheeks are bitten. I once saw the point of the tongue actually severed during an attack. The odaxismus will occur before consciousness is entirely lost. If in the state of semi-consciousness a glass or cup be given to the patient to drink out of, she bites a piece out of it. This has again and again occurred in such cases. In consequence of the closed state of the teeth, the increased secretion of saliva, and the impeded passage of air through the larynx, the breath is expired through the teeth with a harsh sibilant sound, which is quite pathognomonic of the true puerperal convulsion. The hissing respiration, and the bloody saliva thrown out of the mouth during a severe attack, are among the most frightful parts of the seizure, where all is terrible.

Besides the sphagiasmus, laryngismus and odaxismus, another spasmodic action occurs in the upper part of the body. There is *Pharyngismus*, a difficulty or perfect inability to swallow. Matters placed at the base of the tongue, or in the upper part of the pharynx, do not, as usual, excite the act of deglutition, but remain to increase the dangers of suffocation. It is in this state of the pharynx that my friend Mr. Simpson, of Stamford, has excited the deglutition of nutriment and remedies, by placing the substance to be swallowed in the upper part of the pharynx and then douching the face with cold water. This affusion of cold water excites dilatation of the pharynx and deglutition, just as in the case of the larynx it excites dilatation of the glottis and forcible inspiration. This is an important therapeutical point, both in loss of power and in spasmodic closure of the pharyngeal tube. Pharyngismus is present in some cases of epilepsy, and in tetanus and hydrophobia. I once witnessed a fatal case of hydrophobia in which the pharyngismus appeared to continue several hours after death, for the secretion of saliva was kept up, and instead of passing down the œsophagus, it escaped in the state of foam from the mouth and nostrils. All these phenomena undoubtedly happen, and they are both important symptoms and causes of convulsion; they are equally important in the treatment of the disease.

But it has struck me that these are not *all* the causes of impeded circulation and cerebral distention in cases of powerful convulsion. I would add *Cardiasmus* to the other preliminary spasmodic actions. I have carefully watched such cases, and I have thought greater swelling and rigidity of the neck has existed, than could be accounted for by sphagiasmus and laryngismus. The whole neck has appeared distended, becoming broader and fuller during the convulsion from the chin to the clavicle, than I could comprehend to happen from pressure of the cervical veins, unless, indeed, this pressure occurred in the greatest force in the subclavian region. The excessive lividity and turgidity of the whole surface of the body in the severe puerperal attack, is greater, too, than would happen from simple asphyxia. The whole body, appears like the head and neck above the cord, in strangulation. It has appeared to me that some cause adequate to produce this must exist at the very root of the venous system. *May it not be that the muscular fibres of the right auricle contract spasmodically so as to erect, as it were, the entire venous system, from the cavæ to the capillary vessels?* Here I have in view the compression of the dorsal veins of the penis, and its consequent distention and muscular action. Instead of one organ, the whole body is in an erectile condition, and the physiology of erectile organs appears to present us with the types of the pathology of convulsive disease. It was for the sake of illustrating this opinion that I dwelt on these physiological acts at the commencement of the present lecture. This view is remarkably in accordance with what we find in post-mortem examinations, where the auricles and ventricles are perfectly emptied of blood. I believe this cause of convulsion to be especially prominent in those cases in which the fit occurs instantaneously, without previous warning, when the patient drops as if shot. This view applies equally to the convulsions of infancy, epilepsy, and paroxysmal epilepsy.

When these momentous contractions of a spasmodic kind are all complete, the paroxysm of convulsion is raised to its height. They disturb the cerebral and spinal circulation to a considerable extent, but especially the cerebral, and it is now that the danger to the cerebrum occurs. In some of these cases the commencing contortions of the convulsion, instead of simply impeding the return of blood from the cerebrum and medulla oblongata, at once produce effusion of serum or blood within the cranium. The convulsion becomes at the onset changed into apoplexy, but the convulsion is nevertheless continued by pressure and counter-pressure. Effusion may happen at the commencement of the first attack, but more frequently it takes place after the intra-cranial vessels have been weakened by several seizures.

In the puerperal convulsion, still more than in the epileptic seizure, the progress of spasmodic action is from above downwards. The face and neck are first convulsed, then the arms, trunk, and inferior extremities. As the torrent of convulsion passes downwards, the pelvic sphincters become affected, and involuntary passage of the urine and fæces occurs. If parturition is going on, the uterus contracts as in a labour-pain. In the epileptic convulsion in the male, it is well known that erection and *emissio seminis* may take place during the paroxysm. The uterus is sometimes emptied of its contents in the most precipitous manner: more rapidly indeed than under any other circumstances whatever, except in abortion from excessive mental emotion. It sometimes happens that at the commencement of a fit, the os uteri has scarcely commenced its dilatation, but after a short convulsion with uterine action, the child is found entirely expelled. Children have died asphyxiated occasionally from being born under these circumstances and receiving no attention from the accoucheur or nurse. The influence of the convulsion upon the orifices of the pelvic organs is almost as marked as that upon the orifices of the gastric and respiratory canals. The convulsion now occupies the whole of the muscular system, until at length the sphagiasmus, laryngismus, odaxismus, cardiasmus, and pharyngismus relax, and with them the general convulsive action diminishes. Thus the convulsive erethism first affects the medulla oblongata and the reflex arcs in connexion with this part of the spinal centre; afterwards the medulla spinalis, and then the analogue of the medulla oblongata in the lower portion of the medulla, are successively affected.

It must be borne in mind that whatever the cause of the erethismus and the convulsion may be, it is in these modes that the cause probably operates. The whole muscular system is *not* affected simultaneously with convulsion, but certain muscles are first affected, which by their influence upon the nervous centres rouse the general muscular system to the state of spasm. In the sphagiasmus, laryngismus, odaxismus, and pharyngismus, and also in the spasm of the auricle, the medulla oblongata is the portion of the spinal centre which is concerned. The spinal influence is sent to the heart through the branches of the pneumogastric which join the cardiac nerves. Thus it will be seen that the anatomy of the nervous supply to the heart favours the opinion I have ventured to form respecting its state of spasm in convulsion.

The general convulsive action varies very widely. Sometimes there is violent spasm and straightening of the limbs without much movement; at others, it is almost impossible to keep the patient in bed. The spasms may affect one half of the body more than the other, or they may be almost confined to one side. Sometimes the convulsion is opisthotonic, and the body of the patient is bent from the vertex to the heel, like a bow. The duration of the fit is very uncertain; it may continue but for a few seconds, or it may last several hours. In consequence of these variations in the seizure in different subjects, many varieties of puerperal convulsion have been proposed, such as the tetanic, the epileptic, &c. But such a division is of little use in practice, and is, indeed, quite arbitrary. All puerperal convulsive action, attended by unconsciousness and laryngismus, may be classed together; the variations observed are merely in intensity, severity, and duration, and not in kind, or in the mode in which they are caused.

In the puerperal convulsion occurring during parturition itself, the fit may follow or precede the labour-pain regularly, or it may be altogether independent of the action of the uterus. In some cases, the convulsive action of the head and neck first occurs, and then, after the convulsion has reached the lower part of the trunk, the uterine contraction begins. Here the labour-pain becomes, as it were, a part of the convulsion, and is excited by it. In other cases, the pains proceed regularly, but at the commencement of each pain, a convulsion occurs. The pain begins first, and then the convulsive action. Here the action of the uterus evidently excites the convulsion. There are still other cases in which the convulsions occur without producing, or being followed by, labour-pain; the uterus seems altogether exempt from the convulsion, but the pains proceed as usual in the interval between the attacks, the patient being generally insensible.

After an epileptic convulsion, the patient usually recovers consciousness, though even here there is great tendency to somnolence after the fit. This somnolence is probably in part owing to the tendency to continued sphagiasmus of a less decided kind than that which ushers in the actual attack. In the puerperal convulsion, there is in some cases a return of consciousness in the intervals between the fits, but generally, and particularly in convulsion during the progress of parturition, there is coma or insensibility in the intervals. Even the return of the pains do not stimulate the patient to a recovery of consciousness. During the uterine contraction, she may moan and move about in the bed, and the uterus is felt to be hard and erect, but there is neither consciousness nor volition. Here, perhaps, the reflex actions of labour are observed in their greatest purity. All the reflex actions of the various stages of labour continue intact. In the propulsive stages, the respiratory actions are excited, the breath is held, and the reflex movements of expiration are performed just as in natural labour. When there is perfect insensibility during the intervals, either some effusion or disease has probably taken place within the cerebrum, or the sphagiasmus and laryngismus still continue, though not to the same extent as in the actual fit. This insensibility during the intervals should always be carefully watched. We must distinguish between stertor and laryngismus. The more profound the insensibility, the greater the danger. Whenever the insensibility is more profound than the amount of cervical contraction present can account for, or when there is paralysis of any of the limbs, we should suspect intra-cranial effusion. This mixture of convulsions with apoplexy and paralysis is one of the most formidable complications we can meet with. Simple puerperal convulsion, when it proves fatal, destroys the patient by exhaustion, like tetanus, leaving no post-mortem signs; it is far otherwise when the convulsion passes into apoplexy.

The differences between puerperal convulsion and epilepsy are quite as great as the differences between the convulsions of infancy and epilepsy. Epilepsy is generally a chronic, puerperal convulsion always an acute disorder. The one is connected with the ordinary functions of the body, the other attends an extraordinary function of limited duration; namely, childbearing. The cases of epilepsy which at all approach puerperal convulsion are those in which the epileptic is seized with numerous successive fits within a short period. But even here, the epileptic almost always regains his consciousness between the fits; while it is as constantly absent during the intervals of the severe puerperal attack. Altogether, the puerperal attack is more severe than the epileptic, hence the dangers to brain and limb are greater. It is seldom that epilepsy terminates fatally until the patient has been worn down by repeated seizures, extending over a long period of time, while in the attack of puerperal convulsion, whose duration is almost reckoned by hours, a fatal result is frequent.

The suspected affinities between *epilepsy* and *puerperal convulsion* deserve attention. It would seem, *à priori*, that epileptics, or persons who had been subject to convulsion during infancy, would be far more likely than others to attacks of convulsion during the puerperal state. It would also seem probable that patients suffering from puerperal convulsion should become subsequently liable to epileptic attacks. But experience does not positively support either of these probabilities. There are reasons for believing that many puerperal cases arise in those who have been the subjects of convulsion or hysteria in early life. This is evident from the clinical reports of cases, particularly those of Dr. Robert Lee. But so many children suffer from convulsive affections during dentition and the other affections of early life, that it would be difficult to maintain that such coincidences are in the nature of cause and effect. Dr. Lee does not support any such opinion, he merely relates the fact that in forty-eight cases of puerperal convulsion, three had previously suffered from epilepsy, and three from hysteria. It has often happened that epileptic patients have had no signs of convulsion during parturition. Not long since, I had the opportunity of watching the case of a young married lady, an epileptic, who had an attack of epilepsy, *post coitu*, at the time she believed herself to have conceived, but who remained free from convulsion during the whole of her pregnancy and labour. This was the more striking, because her appetite was so capricious that she could not be restrained, particularly during the early months of pregnancy, from taking the most indigestible food. I have before referred to the principle of counter-irritation which sometimes obtains in the spinal system, and during gestation that change in the innervation of various important organs is effected physiologically in epileptic patients, which is so valuable, and which we often attempt in vain by the use of remedies. I have had occasion to mention the rest given to the ovaria by pregnancy; and as ovarian irritation is so very frequent a cause of epilepsy in the female, it may be that this repose contributes to remove the tendency to epilepsy during gestation; so that pregnancy may actually be a means of cure in the ovarian variety of epilepsy. With reference to the next point, I believe epilepsy rarely follows puerperal convulsion. I have not been able, at least, to find cases in which it has occurred. The subjects of puerperal convulsions do not appear to be more liable than other persons to convulsions after the puerperal period has passed. They are, however, liable to convulsions in successive labours, unless carefully attended to. Instances of this have been often recorded. On the whole, then, puerperal convulsion must be considered as a special disorder, having no very marked affinity for other forms of convulsion, particularly the epileptic form.

It is important to distinguish the hysterical convulsions of parturition and pregnancy from the true puerperal convulsion. In the hysterical convulsion, the pharyngismus is the most prominent symptom about the neck. The sphagiasmus is comparatively trifling, and the laryngismus of the true puerperal attack is almost entirely absent. Instead of the hissing respiration and the closing larynx, there are screaming and other indications of an open state of the glottis. There is sensibility in the intervals of the hysterical attacks, and volition appears not to be altogether abolished during the spasmodic actions. Generally in hysterical spasms, the thumb, instead of being turned inwards in the palm of the hand, is clenched on the outside of the closed fingers. Hysterical affections are chiefly confined to the early months of pregnancy, while puerperal convulsions belong to the later months and the puerperal period. It is, however, of very great importance, on the one side, not to be imposed upon by hysterical disease, and, on the other, not to treat the true puerperal convulsion as hysteria.

In laughing, particularly in violent laughter, the veins of the neck and face are visibly distended. Convulsions or even apoplexy have occurred during a fit of laughing. In other words, sphagiasmus occurs as the result of the motor action of laughing. So in crying, the same fulness of the veins is observed, and from the same cause. Thus we see the meaning of the connexion between laughing and crying and hysteria.

All that is cerebral in an hysterical attack is merely an excess of the actions of laughter and weeping, together with pharyngismus. The *globus hystericus*, or the spasmodic contraction of the sphincter gulæ, as the superior constrictor of the pharynx was called by the older anatomists, is to hysteria what laryngismus is to true convulsion. Emotion seems to exert the same influence upon the pharynx, which reflex action does upon the larynx. The *risus sardonicus* is another variation of sphagiasmus, in which the platysma myoides is one of the muscles principally concerned. In singing, some degree of sphagiasmus is present, from the state of the muscles of the neck; in great vocal efforts this becomes very considerable. Those who have watched the great cantatrice of the North—the incomparable Lind—during one of her wonderful scenes, in which song and madness are combined, must have observed the swollen state of the veins of the head, and the almost convulsive workings of the muscles of the neck, face, and larynx, which are increased until she seems upon the very point of falling into the madness she impersonates.

Dr. M. Hall has described a cerebral epilepsy, in which sphagiasmus is the immediate cause and symptom of the attack, and in which the cerebrum is alone involved. He says:—"From this symptom, (sphagiasmus,) which must be viewed in its double aspect of contraction of certain muscles of the neck, and of compression of the veins of the neck, all that is purely cerebral in epilepsy immediately arises; affections of the senses—the eye, the ear, the senses of smell and taste, and often touch, affections of the intellect, &c.; thus before the eyes there are flashes of light, flocci volitantes, or mist; in the ears there are various noises, as of a cataract, or of machinery, or musketry; there is the smell or taste of musk or fæces, and the sense of touch is affected by the well-known aura epileptica. In regard to the intellect, we have the 'oblivium' and the 'delirium breve' so beautifully described by Heberden, with various affections of the sleep and the memory." And again, Dr. M. Hall observes, "*all* that depends on sphagiasmus, *all* that falls short of laryngismus, may be viewed, in general terms, as cerebral epilepsy; whilst all that is beyond this term is violent convulsion, with its further still more fearful consequences—congestion of the cerebrum, of the cerebellum, and doubtless also of the medulla oblongata. How well does the classic Heberden admonish us, that—'instante accessione epileptica diligentur providendum est, ut omnes illæ vestium partes, quæ collum cingunt quam primum laxentur; *hoc enim interdum adeo tumet ut strangulationis metus impendeat.*'"

This cerebral convulsion occurs at the commencement of every puerperal convulsion, and sometimes the attack does not pass beyond the cerebral seizure. There is sudden loss of consciousness, and sphagiasmus without general convulsion. In the epileptic disease, the cerebral seizure is generally transient, but in the puerperal state the cerebral seizure may occur, and be followed by hours or even days of insensibility, or the patient may not awake, except to puerperal insanity. In some cases, the cerebral seizure alone proves fatal, passing into apoplexy before any convulsive action is set up. In others, it leads to cerebritis and meningitis.

Not long since, I saw, with Dr. Cormack of Putney, in the same lady, in a dangerous abortion, cerebral syncope, convulsive action of the muscles of the upper part of the body, and delirium. These three conditions alternated with each other, and were all accompanied with, or produced by, sphagiasmus. Whenever she fainted, or was delirious, or convulsed, the same fulness of the neck was observed.

During the whole of labour, after the full dilatation of the os uteri, some amount of sphagiasmus is present. In the pain itself there is cerebral excitement, but in the intervals between the pains, the patient is heavy, or she may fall asleep until roused by the next pain. The heaviness after a pain appears to depend on the slightly congested state of the cerebrum, which continues after the active contraction has ceased, or some amount of sphagiasmus may continue during the pains. It is probably on this state of the cerebrum that some of the perfect freedom from pain and forgetfulness of suffering in the interval, depend.

At the moment of birth, when the muscular actions and the consequent disturbance of the cerebral circulation are at the highest pitch, the mother may become furiously insane for a few moments. There can be little doubt that this paroxysmal insanity depends upon the impeded return of blood from the head, produced by the state of the cervical muscles. This transient insanity very well illustrates some other forms of paroxysmal mania occurring during the puerperal state.

As puerperal convulsion is so generally a more acute disease than epilepsy, the relation between this convulsion and mania is more immediate than the connexion between epilepsy and mania. In epilepsy, after the brain has been disordered by numerous attacks, it is common for insanity to occur. But in the puerperal disorder, insanity may follow in a few hours from the time of the first seizure. Not only is the convulsive seizure more acute, but the spinal erethismus which produces the convulsion affects the cerebrum so as to predispose it to insanity, cerebral inflammation, softening, effusion, &c. The relation between the cerebral seizure, the full puerperal convulsion, and puerperal mania, is in every point of view most intimate, and the one very frequently runs into the other. Generally, the order in which they occur is as I have placed them, and it sometimes happens that the maniacal paroxysm is the first to be developed, and the convulsion follows. This supervention of convulsion upon mania is more frequent after parturition than it is before or during labour, but this complication occasionally occurs during pregnancy. In paroxysmal mania of the puerperal type sphagiasmus is always present. The causes of the disease are similar to the causes of convulsion, and are often relieved by the identical measures which relieve convulsion. Gooch pointed out how miraculously puerperal mania was sometimes relieved by the removal of alvine accumulations. Here the irritation of the intestines must produce the erethismal condition, the sphagiasmus, and the cerebral disorder, but the stress of the disorder, instead of falling on the spinal system after this point, takes the cerebral form. Thus the detection of sphagiasmus has an important application in therapeutics. Observing it, we act in the light instead of in the dark.

Must we view the actions of convulsion and of its related diseases as purely destructive ! Or can we see a germ of intention towards salutary acts in the economy in these singularly dangerous and alarming diseases ? The reflex causes of convulsion, puerperal and epileptic, are chiefly irritations of the mucous canals. In convulsion, all the egestive acts of the economy are frequently performed with greater energy than under any other circumstances. The stomach is emptied, the fœtus is expelled, the rectum and bladder are contracted, though accompanied by the terrible actions which are so perilous to life. It seems, then, that we may detect a latent intention in these seizures, and one which, if at all indicative of treatment, would point to the measures which should really be pursued.

There is another question of practical importance which may be referred to. Can we learn anything of the physiognomy of the different forms of convulsion ? The convulsions of infancy, of epilepsy, of hysteria, and of the puerperal paroxysm, possess each of them their distinctive physiognomies taken in the mass. Can we learn the physiognomy of the uterine as distinct from the gastric convulsion, or of the reflex from the direct attack in the puerperal disease ? Have the muscular spasms any characteristic peculiarities according as they arise from irritation of one organ or another, or according as the irritation affects the periphery, or the centre of the spinal system ?

When discussing the cause of sleep, I referred to the state of the ophthalmic circulation. There is a peculiarity in the venous circulation within the orbit which may in part explain the connexion between closure of the orbicularis palpebrarum and sleep. The ophthalmic, frontal, and facial veins communicate very freely by means of the angular branch of the ophthalmic at the inner canthus of the eye. It is precisely in this situation that the orbicular contraction is most considerable during sleep. In the upright posture, or in any position, when the eyelids are open it is extremely likely that the whole or a great portion of the venous blood of the orbit returns towards the heart by way of the frontal and facial veins, while during sleep and the consequent compression of the angular vein the blood may return by way of the ophthalmic vein, so as to increase the cerebral venous congestion of sleep. Thus the angular vein may, in the healthy state of the orbicularis, be one of the auxiliary mechanisms of sleep.

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LECTURE XXIII.

BLOODLETTING IN PUERPERAL CONVULSION. DILATATION OF THE GLOTTIS.—APPLICATION OF COLD. ADMINISTRATION OF OPIUM. REGULATION OF EMOTION. TREATMENT OF SPHAGIASMUS AND CERVICAL MUSCULAR ACTION. REMOVAL OF THE REFLEX CAUSES OF CONVULSION. EVACUATION OF THE STOMACH, BOWELS, BLADDER, AND UTERUS. A CASE, AND A COMMENTARY THEREON.

After having considered the prevalent theories, the causes, and the phenomena of puerperal convulsions, it still remains to give an account of the treatment of this malady.

In treating of the pathology of puerperal convulsions, I have endeavoured to show that the disease must always depend on one of two causes,—either on direct irritation of the spinal marrow, or on some irritation of excitor spinal nerves. If there be any truth in this view, it is evident that remedies also should be divided into those which allay irritation of the spinal centre, and those which remove irritation from the incident excitor nerves, or diminish their excitability. A large and important class of diseases are referrible to the spinal system, and every branch of this new department of pathology calls for some therapeutic division of this kind. Medicines must be studied with reference to their effects on the different divisions of the nervous system. Unless the spinal marrow be dissevered, therapeutically, as well as physiologically, from the other nervous centres, the anomaly presents itself, of remedies which act as stimulants to the spinal marrow, but as sedatives to the brain, and *vice versâ*. Indeed, on looking to the three great divisions of neurology—the Brain, the Spinal Marrow, and the Ganglionic System—remarkable instances at once present themselves of therapeutic agents which affect them severally in the most opposite modes. Thus the ergot of rye increases the contractions of the uterus, an organ chiefly under the control of the spinal marrow, but it depresses the action of the heart, which is under the control of ganglionic nerves; strychnia affects the purely spinal actions to an intense degree, leaving the functions of the brain perfectly intact; while conium, on the other hand, affects, in poisonous doses, both the spinal marrow and the brain, producing at once delirium and convulsions.

The spinal system being that which is chiefly involved in puerperal convulsions, all remedies resorted to in this disease must be studied with especial reference to spinal physiology and pathology.

Remedies affecting the spinal system very naturally divide themselves into those which act on the central organ, the spinal marrow, and those which affect the extremities of incident spinal nerves. I propose, in the first instance, to consider the remedies of DIRECT or CENTRIC action.

Bloodletting.—The action of bloodletting on the spinal marrow is greatly modified by the condition of the circulation. In fulness of the vascular system, it is the most powerful sedative of spinal action we possess. Hence, venesection is the grand remedy in the simpler form of puerperal convulsion, where the disease chiefly depends on stimulation of the spinal marrow by excess of blood, or on the mechanical pressure exerted by the blood on that organ, together with the counter-pressure of the distended brain on the medulla oblongata. In such cases, bleeding should be performed with a view to its sedative action on the spinal marrow, and to avert the mechanical effects of vascular pressure from this organ. Alone, it will frequently be sufficient to subdue the disease, particularly when the fits come on before the beginning of labour, or after delivery. But another most important intention of bloodletting should never be lost sight of—namely, that of preserving the brain from injury during the convulsion. Besides the *primary* cerebral congestion, which may have been the cause of the attack by its counter-pressure on the medulla, the convulsive action itself, with the glottis closed, and the various sphincteric actions in operation which were considered in the former lecture, exerting great muscular pressure on the whole vascular system, and causing, as they must, the greatest turgidity of the vessels of the head, are dangerous sources of fatal cerebral congestion, or of serous or sanguineous effusion. As in the case of epileptics, women in puerperal convulsions frequently die of apoplexy, produced by the immense pressure exerted on the cerebral column of blood during the fits. It is in great measure from the effects of bloodletting in warding off accident from the brain that bleeding is so universal in this disease. The due recognition of the distinct operation of bloodletting on the cerebral and spinal systems is of the utmost consequence. In plethoric states of the circulation, it is in this disease *curative* in its action on the spinal marrow, *preventive* in its action on the brain.

In the absence of definite ideas regarding the effects of bloodletting in this malady, it has been often pushed to excess, or practised where it should have been altogether avoided. In the numerous cases where, beside vascular excitement of the spinal marrow, some irritation of spinal excitor nerves exists as a conjoined cause of convulsion, repeated bleedings will often fail to subdue the disease, unless the *eccentric* irritation be at the same time removed. When irritation of the uterus, the rectum, or the stomach, is in part excitor of the convulsion, bleeding *alone* cannot be relied on. It may at first diminish the impressibility of the *central* organ, rendering it less susceptible of the incident irritation, but if persisted in to a large extent without the removal of the *eccentric* irritation, it becomes in the end positively injurious, by increasing instead of diminishing the excitability of the spinal marrow.

In vascular plethora, depletion is undoubtedly a sedative to the spinal system, but when the circulation is reduced considerably below par, loss of blood becomes an actual stimulant to this organ. Hence it is that the reports of those who have most pertinaciously followed bloodletting, exhibit the loss of a greater number of patients than those who have been more cautious in this respect. The propriety and extent of venesection must be estimated, then, not by the violence of the disease, but by the state of the circulation in the interval of the fits, and with especial reference to the different effects of

MANCHESTER MEDICAL SOCIETY

vascular plethora and vacuity upon the spinal centre. I should avoid these manifest repetitions had I not thoroughly convinced myself that patients rightly bled in the first instance are frequently subjected to successive depletion until loss of blood itself becomes the cause of the final seizures. Nothing is, I believe, more certain to remove this deplorable source of mischief than the distinct perception of the effects of venesection on the spinal marrow, the true organ of puerperal convulsion.

Similar remarks would apply with almost equal force to the other parts of the common antiphlogistic regimen. Nearly allied to the *modus operandi* of bleeding are the effects of nauseating doses of emetic-tartar, which have been found so serviceable in the treatment of puerperal convulsions by Dr. Collins. It is more than probable that this remedy acts as a sedative on the spinal system through the medium of its effects on the circulation.

In the convulsion occurring in delicate anæmic women, bleeding is generally inadmissible, becoming in fact, under such circumstances, an exciting cause of the disease. Still, in cases approaching to this state, cautious bleeding may be sometimes necessary to *preserve* the brain from injury, but here venesection requires to be followed promptly by stimulants: such cases are, however, rare in comparison with those in which fulness of the circulation exists at the onset of the disease.

Dilatation of the Glottis.—During the attack of convulsion the glottis is partially or entirely closed. The greatest authority on this point, Dr. Marshall Hall, questions if true convulsion could ever occur without this state of the glottis, and the cerebral and spinal congestion which it occasions. We know that the epileptic attack is sometimes warded off by the dash of cold water on the face or chest, so as to excite a sudden inspiration and the dilatation of the glottis. It is on the same principle, that of exciting a strong inspiratory act, that we stimulate the nostrils or sprinkle the face with cold water in syncope. Excitation of the incident nerves of inspiration has in the same way been known to prevent the puerperal convulsion.

Harvey gives an instance in which stimulation of the trifacial nerve within the nostrils recovered a woman who became comatose during labour. Denman also relates an interesting case, in which a convulsion was excited during every labour-pain, but in which he kept off the attacks, until delivery was completed, simply by throwing cold water on the face with a bunch of feathers at each accession of pain. It was found that this mode of proceeding, from which he augured so favourably from its effects in this and other cases, did not prove equally efficacious on all occasions. He observes, that this is "a safe remedy," which cannot be said of all measures resorted to in this disease. It must certainly be productive of benefit in cases where the glottis is not so firmly locked as to render its dilatation by this means impossible. Even if it does nothing to prevent the accession of the fit, every time we can dilate the glottis, and cause a full inspiration, we take off a considerable amount of vascular pressure from the nervous centres, and lessen the proportion of venous blood in the system.

The Application of Cold.—Cold, applied to the head in the form of napkins, lightly wrung out of cold or iced water, ice itself, or a full stream of cold water poured from a height, has become an approved remedy in puerperal convulsions. It therefore becomes an interesting question—How does cold thus used act on the nervous system? It may act as a sedative on the cerebral portion of the spinal marrow, or it may lessen the distended state of the cerebral circulation, and thus relieve the counter-pressure of the brain on the intra-cranial portions of the spinal system. Probably it acts in both of these modes. When used in the form of the continuous douche, as sometimes recommended, it would, in addition, tend to excite acts of inspiration, and thus dilate the glottis. The primary sedative action of cold on the spinal centre would seem to be shown satisfactorily by the reputed good effects of cold applied to the whole length of the spinal column in tetanus.

The application of cold to the spine as well as to the head may hereafter be found beneficial in puerperal convulsions. Whenever cold in any form is resorted to, its use, except for the purpose of exciting the respiration, must be continuous, as the intermittent application of cold, locally or generally, would excite instead of allay the spinal system. The benefit derivable from cold appears to arise from its local action on the nervous centres, because in tetanus, the purest form of increased morbid spinal action, cold applied to the spine is serviccable, whereas, when applied to the whole surface of the body, it is extremely dangerous, and even fatal.

Administration of Opium.—It is an object of very great therapeutic importance to ascertain the true effects of opium on the spinal system. One author maintains that opium diminishes the contractions of the uterus in after-pains, another, that it increases their energy. Some recommend it in uterine hæmorrhage, as an efficient means of exciting uterine contractions, while some blame its administration on the plea that it produces uterine inertia and hæmorrhage. Some, again, maintain that it retards, and others that it accelerates, the progress of labour. With respect to the propriety of its use in convulsions, there is a great discrepancy of opinion. Though we may not yet have sufficient data to form a perfect and decisive judgment, I believe we can at the present time make a very considerable advance in the right direction.

When the amphibia are in a state of narcotization from opium, the whole excito-motor system is exalted to an intense degree. The slightest irritation of the surface of the body produces universal convulsions. If this fact were applicable to man, it would be an argument to show that it is a powerful spinal stimulant, as it certainly is in the amphibia. In the state of narcotization by opium in man, there is no positive evidence that the incident spinal nerves are more excitor than at other times; still, in poisoning by opium, convulsions occur, particularly in children, as one of its common toxicological effects. In poisoning by belladonna, convulsive action is much more rare, and it has been found by Dr. Hutchinson, of Nottingham, a successful cultivator of spinal pathology and therapeutics, that belladonna exerts a sedative influence on the spinal marrow in tetanus. That opium does not, in man, allay excitement of the spinal marrow, is shown by its failure in the treatment of tetanus and hydrophobia, the purest and most intense forms of morbid spinal action. The patient may be poisoned by opium without any reduction of the spasm.

Mr. Bonney, in a paper on the effect of opiates, has ingeniously suggested that they prove indirectly stimulant to the reflex actions, because the arrest of the cerebral functions they occasion, increases the muscular irritability. I think there are reasons for supposing that, besides this effect, which is very probable, opium is a direct excitant of the spinal system. It aggravates convulsions, when there is already a state of insensibility from other causes, and when, therefore, this explanation could not be received. It is the general opinion of practical men, that opiates are injurious in the convulsions of children, in epilepsy, and in puerperal convulsions; and it is certainly of little or no value, probably, indeed, it is prejudicial, in tetanus, hydrophobia, and other severe diseases of increased action in the excito-motor system.

Some striking distinctions must be made respecting the administration of opium under different circumstances, particularly in puerperal convulsions. If a dose of opium be given in this disease in a full state of the circulation, before bleeding, there is an aggravation of the disorder; while if it be given in puerperal convulsions in an anæmic subject, or after excessive depletion, it is of great service. If in a case of convulsions opium be given at the commencement, it is dangerous in its effects; but the same medicine is frequently valuable in the advanced stage of the same case when the vascular system has been powerfully depleted. Thus it would appear evident that in convulsions with a full state of the circulation, opium is a *stimulant* to the spinal marrow, while in convulsions with anæmia, it is distinctly *sedative*. It is certainly an important point in practice, that the effects of opium in puerperal convulsion depend on the state of the circulation; that in plethoric or inflammatory conditions it is always dangerous, while in anæmia and debility it may always be used beneficially.

Emotion.—The regulation of emotion is of considerable importance in preventing the accession of convulsions when they are threatened, and in averting the return of the attacks, in the intervals where *consciousness* is retained. Mental excitement of every kind should be soothed, and avoided as much as possible. The sight of the infant, of alarmed friends or relatives, unpleasant intelligence, noises in the sick chamber, or still more trifling matters, have caused or renewed convulsions. Perfect quiet and repose within the sick room, and the absence of all signs of excitement on the part of the attendants, are of the utmost consequence; the calm or timid look of the professional man may either excite or prevent a fit. The *psychical* effects of emotion upon the spinal marrow —an otherwise purely *physical* organ, in health and disease— is one of the most striking and indubitable facts furnished by the pathology and physiology of the spinal system.

Relief of the Sphagiasmus and other Spasmodic Contractions of the Neck.—During ordinary labours care should be taken to avoid increasing the tendency to cervical contractions; this is still more important in labours with symptoms of spinal erethismus, or threatening convulsion. Care should be taken that during the propulsive and expulsive stages of labour the reflex contractions about the neck should not be increased by excessive voluntary efforts, or by violent emotional disturbance. When the neck becomes tumid at each returning pain, the reflex cervical contractions should be moderated by directing the patient, not only to withhold voluntary action of this kind, but to cry out during the pains, so as to keep the larynx open. In this way sphagiasmus and laryngismus may both be prevented by volition, in some cases. If the cervical symptoms are severe, venesection should be practised before the accession of convulsion, as a preventive measure. Whenever fulness of the neck occurs, either before or after labour, so as to create an apprehension of convulsion, blood should be taken from the head by leeches, or by cupping. There is no point of greater importance in the prophylaxis of puerperal convulsion than an attention to the state of the cervical region; it is to convulsion what the pulse is to inflammation.

Removal of Reflex Causes of Convulsion.—In threatened convulsion, or after the invasion of the disease, it is of the utmost importance to seek out and remove all sources of reflex irritation. Remote causes of irritation should be sought for, and removed with the greatest care. The state of the Stomach, the Intestines, the Breasts, the Bladder, and other organs in reflex relation with the uterus, should be examined. The recollection of the cases in which I detailed the different reflex varieties of convulsion will at once suggest the appropriate remedies for the relief of these organs. If the fit has occurred after a full meal, or after indigestible food, an *emetic* of the sulphate of zinc should be administered. If there should be vascular fulness, venesection ought to be performed. The bleeding should precede the emetic, to diminish the danger to the cerebrum from the action of vomiting, for emetics given incautiously have occasionally produced sudden death in puerperal convulsion. However, when the gastric irritation is undoubted, no patient should be suffered to continue in the fits with the stomach unrelieved. It may seem superfluous to urge this, but I have known cases of convulsion from gastric irritation, in which the most sedulous attention has been shown to almost every other organ in the body, except the right one. Still more important than the stomach is the state of the bowels. In convulsions the intestines are very commonly loaded; it immediately becomes a question how to relieve them without producing greater irritation by the operation than already exists from their loaded condition. The most violent drastics have been given in such cases without any ceremony, as though the more rudely the materies morbi were grasped, the more effective the remedy. But it is of great importance to avoid irritating the intestinal canal unnecessarily. I have known puerperal convulsions produced by giving a brisk cathartic too soon after delivery. In fact, there is little difference between irritant drugs and irritant fæcal matter. Therefore, whenever the bowels can be opened without purgatives administered by the mouth, but by aperient *enemata*, the latter are greatly to be preferred. When we give a cathartic, we never know how long it may remain to fret the bowels, but an enema is sure to return almost immediately. Washing out the bowel is less irritating than drastic cathartics, and equally effective in removing fæcal accumulations. A copious enema of warm water, repeated until free evacuation has been produced, has often relieved convulsion. If the warm water injection should be insufficient, castor oil, or turpentine, may be added. Sometimes the constipation is so obstinate as to refuse to yield either to enemata or cathartics, and the contents of the bowels positively require to be dug out. I have seen a case of this kind, in which the fæces were as hard as the *album græcum* of the dog, and in which their excavation was followed by almost instant relief of violent convulsions.

The state of the bladder should always be attended to in puerperal convulsion, particularly as, during the insensibility of the intervals, the patient is unable to inform the attendant of its distended condition. This may be a slight thing to mention, but the catheter has sometimes relieved convulsion when the lancet has failed.

But the great seat of reflex irritation in puerperal convulsion is in the parturient canal. There is only one direct mode in which uterine irritation can be allayed during puerperal convulsion, except by the removal of the fœtus. This is by *the evacuation of the liquor amnii.* In cases of puerperal convulsion, puncturing the membranes takes off a considerable amount of distention from the uterus; diminishing the size of the organ, and the quantity of blood circulating through it. Hence, though it renders the uterus more active, by bringing its parietes into contact with the fœtus, it renders the organ itself less irritating to the general spinal system. The evacuation of the liquor amnii is to the uterus what the partial action of an emetic or an enema is to the stomach and intestines. In convulsion from uterine irritation, much may be done by the avoidance of all unnecessary dilatation and interference with the vagina and os uteri. During convulsions, all operations upon the parturient canal, whether they consist of examinations, dilatation of the os uteri and the vagina, the artificial removal of the fœtus, or the extraction of the placenta, should be performed with the greatest care, and with the conviction of the case with which renewed fits may be excited by any irritation of the uterine passages.

The relation of *artificial delivery* to puerperal convulsion is a matter of deep interest. Some obstetricians have recommended that it should always be performed by turning, craniotomy, or the forceps, when the fits are obstinate and severe. In deciding this point, the particular characters of individual cases must be considered. The general principle which we may deduce is, that whenever artificial delivery can be effected with less irritation than would be produced by the continuance of the child in the parturient canal, and its expulsion by the natural process, it is advisable that it should be performed, if the situation of the mother be perilous. It must be with reference to this principle—namely, to the irritation of any particular operation, and the irritation of the *statu quo*—that turning, craniotomy, or the forceps, must be decided upon. All these operations have destroyed patients; and, on the other hand, numbers have died undelivered, from uterine irritation. The question of interference is one for which no arbitrary rule can be laid down, but which must be decided in each individual case by the particular circumstance, due reference being had to the excitability of the uterus under the stimulus of the fœtus, and under artificial interference. The point to aim at should be, never to produce more irritation than we remove, and not to destroy the patient by an excessive temporary irritation instituted for her permanent relief, by the entire evacuation of the parturient canal. Of course, the greater the operation necessary to delivery, the greater is the deliberation necessary before it is commenced. In manipulating upon the uterus under such circumstances, we must never for a moment lose sight of its reflex connexion with the spinal marrow. Such are the principles upon which we must attack the uterus in puerperal convulsion. Every measure we resort to for the relief of uterine irritation and the evacuation of its contents exerts a salutary influence upon the ovaria, and there is no other mode of relieving ovarian irritation that we can resort to, except it be constitutional treatment, or the evacuation of the rectum and bladder.

Perhaps I cannot conclude this subject better than by quoting a case, and a commentary upon it, which I published two or three years ago. The case occurred in the practice of, and was published, in the first instance, by, a highly respectable accoucheur; in condensing it from his own account I have most scrupulously adhered to every important particular of his narration. The example may be more forcible than precept.

Case.—The medical attendant was summoned at one A.M., and found the patient had been in labour three hours. The os uteri was dilated to nearly the size of a crown-piece, but remained rigid; the membranes were unbroken, and a foot presented. The patient had suffered from headach during the latter part of pregnancy, and this pain continued during labour. At half-past two A.M. she was seized with the *first* convulsion during a pain, upon which thirty ounces of blood were taken from the arm, the hair removed, and cold applied to the head. The *second* fit speedily occurred, and thirty ounces of blood was again drawn. Delivery was now decided on; the membranes were ruptured, and the feet brought down, after which the head was extracted by the forceps. During the operation the *third* fit occurred. The child was still-born, but the *fourth* fit followed so rapidly that the attendant was diverted from the means proper for its recovery, and the child was lost. A second child was now found presenting with the head; at this period *the bladder was evacuated by the catheter.* The membranes were ruptured by the hand, and the head was rapidly brought down to within reach of the forceps by a powerful pain. The *fifth* fit now occurred. The patient was again bled to twenty ounces, and the forceps immediately applied, the delivery being completed at four A.M. *On attempting to apply a bandage over the uterus, the sixth fit came on.* A consultation was now held, and ten or twelve ounces of blood were taken. In less than twenty minutes there was a *seventh* attack. The patient being now comatose, with cold extremities, and a scarcely perceptible pulse, sinapisms were applied to the legs; and at this juncture, being, as nearly as can be gathered from the narrative, about three hours and a half from the first seizure, and after *seven* attacks of convulsion, *a stimulating enema was exhibited.* At seven A.M. the sinapisms had acted, and the enema had "*brought away a copious offensive dejection.*" Cold applications to the head were continued, and two grains of calomel were given. From the time the bowels were thus acted on, the patient remained *five hours* without any recurrence of the fits; but at two P.M., *the bandage was again attempted to be applied, and the eighth fit instantly occurred.* After a second consultation, *a blister was placed on the scalp*, mercurial frictions were ordered, and calomel every hour. *In the three succeeding hours to the time of the application of the blister—that is, up to six P.M.—five more fits of unabated severity took place.* The respiration and the action of the heart were now inaudible, and at this juncture the blister was removed from the scalp, and the back rubbed with spirits of turpentine, after which the sacrum was covered by a blister, and an enema of hyoscyamus, valerian, and assafœtida administered. By ten o'clock P.M. the respiration was again audible, and the pulse was perceptible in the extremities, while there had been no return of the fits. Up to five A.M. of the following day, three more anodyne enemata had been administered, no material alteration having taken place in the other parts of the treatment; but after the *thirteen* fits of which the occurrence is detailed, the patient continued free from convulsion, and eventually recovered.

In the reflections by the original relator of this case, there is considerable confusion as regards its pathology. In one place, he considered he had "to contend with sanguineous apoplexy, which fortunately, proved to be only of a congestive character;" an idea to which the copious bloodletting was probably attributable. In another, he considered the primary irritation to be seated in the "nervous ganglia" of the uterus, which probably led to the application of the blister in the sacral region. How the two causes were, in his estimation, connected together, he does not attempt to explain. Indeed, he does not appear to have entertained them both at the same time. In his remarks on his own treatment, he strongly suspected the loss of less than ninety ounces of blood might have sufficed; and he was persuaded, that if the after-treatment—that is, the anodyne enemata, and the blister to the sacrum—had been earlier employed, "the patient would have been spared much suffering, and relieved from the agonizing pulsative headachs, and other ills attendant upon an extensive loss of blood." He conceived that "the blister to the scalp proved injurious rather than beneficial, as it was followed by more determination to the brain, evinced by greater lividity of the countenance in the intervals, and a more rapid succession of the fits."

COMMENTARY.—I believe I should be warranted by the facts, by the history of the disease, and by the circumstances attending the application of the different parts of the treatment, in considering this case one of convulsions caused by a loaded state of the lower bowel, the woman being predisposed to the attack by the excitable state of the spinal marrow incident to labour. The fits continued in spite of venesection and delivery. After seven attacks in little more three hours, the bowels were cleared by an *enema*, and the fits immediately ceased for five hours, and then only recurred when the attendant endeavoured to put on an abdominal bandage. When six more attacks had supervened, and the patient was *in extremis*, anodyne *enemata*, and a blister to the sacrum, were resorted to. From this time the fits ceased altogether. The credit of this second remission is given by the relator partly to the injections, and partly to the counter-irritation. This I think erroneous; the enema acted at once, and the fits, which were following each other rapidly, (five severe ones having occurred within four hours,) ceased at once also, while the blister had only acted "pretty efficaciously" at the end of three hours.

Looking to the principles I have endeavoured to lay down respecting the pathology of puerperal convulsions—that the convulsions are caused by irritation applied to the extremities of excitor spinal nerves, or by irritation of the centric organ, it is clear that the irritation in this case was chiefly *eccentric*, and that at least one half of the fits depended on reflex sources of spinal irritation supplied by the acconcheur. Thus, one fit occurred from the first application of the forceps, another was caused by the irritation of the uterus in the first attempt to apply the abdominal bandage, and a third fit by the second attempt at its application. The fourth bleeding brought on a convulsion, the woman having probably, at this time, reached the state in which convulsions of *centric* or direct origin occur from loss of blood. Five more fits followed the application of the blister to the scalp, the author candidly acknowledging that this proceeding proved injurious. On the whole, I do not hesitate to assert, that if, before or after delivery, the intestine had been washed out by an enema, as it should be in almost every case of puerperal convulsion, and the patient kept perfectly free from irritation, there would have been no attack after the birth of the second child, and the patient would have had *six* fits, or a less number, instead of *thirteen!*

The conclusion drawn by the accoucheur is curious—namely, that of recommending, in future cases, the conjoined use of anodyne and anti-spasmodic enemata, and counter-irritation over the sacrum. Now, it is not a question of the application of blisters to one place or another; vesication of the sacrum would excite the spinal marrow nearly as much as vesication of the scalp. In applying an anodyne to the rectal excitor nerves, and an excitant to the posterior sacral nerves, he attacked the spinal marrow, on the one hand, with a stimulant, on the other, with a sedative. It was like putting a horse to each end of a cart, and applying the whip—of course, the quickest and strongest had the mastery. In active diseases of the excito-motor system, such as tetanus or convulsion, counter-irritants are most unphilosophical; they as clearly increase spasmodic action as pinching the limb of a frog, tetanic from strychnia, increases its convulsions, and in the same manner—namely, by the irritation of excitor spinal nerves.

I trust my intentions in the present remarks will not be misunderstood. I have not the most remote desire to make a criticism or an attack on the management of any particular case. Through the one selected, I have aimed at errors widely prevalent, for I maintain that the average practice in puerperal convulsions is not superior to that adopted in this particular case. With the light of spinal pathology and therapeutics thrown full upon the subject, it would be easy to go among the recorded cases of this malady, and here lay a finger on the case of a patient suffered to die of an excito-motor disease with her stomach full of indigestible food, or a loaded rectum, in fact, untreated; there, on the case of another, in which the convulsions at first depended on fulness of the circulation, but in which bleeding after bleeding was performed, till at length the fits came to be caused by very emptiness of the bloodvessels, the convulsions being kept up in the meantime by some irritation supplied by the attendant: as, for instance, in the foregoing case, in which the *sixth* attack, having been most indubitably caused by the irritation of the bandage, was treated by a bleeding, which in turn excited other fits, and this at a time when perfect rest was alone required. The due admixture of *principles* with *empirical practice* must remove such anomalies from obstetric medicine.

MANCHESTER MEDICAL SOCIETY

LECTURE XXIV.

CAUSES OF UTERINE INERTIA. STATES OF THE LIQUOR AMNII. STATE OF THE ABDOMINAL MUSCLES. UTERINE DISPLACEMENTS. PECULIAR DANGERS OF THE PROPULSIVE AND EXPULSIVE STAGES. COMPLICATION OF LABOUR WITH THORACIC, ABDOMINAL, AND PARAPLEGIC DISEASE. CAUSES OF DEFICIENCY OF EXCITO-MOTOR ACTION. TREATMENT OF UTERINE INERTIA. REST. OPIATES. EVACUATION OF THE LIQUOR AMNII. EXAMINATIONS. STIMULANT ENEMATA. ABDOMINAL BANDAGE. POSITION. ERGOT OF RYE. GALVANISM. INSTRUMENTAL INTERFERENCE.

Many conditions of the liquor amnii may interfere with the due contraction of the uterus.

Excessive distention of the uterus by the amniotic fluid produces comparative inertia, from the disadvantage at which the contractile tissue acts under such circumstances. Owing to this cause, the stage of dilatation is sometimes rendered excessively tedious. The remedy is simple; it consists in rupturing the membranes, and in exerting pressure upon the abdomen.

Uterine action is also interfered with by rigidity of the membranes, and the consequent retention of the liquor amnii after the stage of dilatation has passed by. When the os uteri is fully dilated, the fluid pressure of the membranes has no further purpose to serve in parturition. It is inadequate to excite through the medium of the uterus and vagina those powerful efforts which characterize the stages of propulsion and expulsion. Hence, if the membranes remain unbroken after the orificial dilatation, the labour-pains of the subsequent stages are not stronger than those of the stage of dilatation, and they are consequently unequal to the projection of the fœtus. The remedy is obvious here also—namely, to evacuate the membranes on the full completion of the stage of dilatation. This may be done by the finger-nail, or the stilet, but generally the former is sufficient.

Again, the uterus is sometimes enfeebled by premature rupture of the membranes. If at the commencement of the dilatation of the os uteri the liquor amnii be expelled, the uterine actions are generally increased beyond the natural strength, but there are cases in which the escape of the waters at this time quite suspends the actions of labour; the uterus appears baulked of its aim, and becomes inert for many hours or even days. In any case, the membranes should be preserved, unless the quantity of liquor amnii is excessive, with the utmost care in natural labours, until full dilatation has been reached.

There is another source of inertia of the uterus connected with the liquor amnii—namely, the slow discharge of the waters. In normal cases, the waters escape with a gush, or in a short time after the rupture of the membranes, when the uterus closes at once with the fœtus, in order to propel it through the vagina. But it sometimes happens, either because of the undilated state of the os uteri, or a small aperture in the membranes, or, as is more common, the closure of the vagina by the advancing head; that the waters dribble away in small quantities at each returning pain. The uterine action is feeble from the want of resistance, and the effect of the pain upon the fœtus is inconsiderable, because at each returning action of the uterus its force is spent in expelling a small quantity of fluid instead of impelling the solid contents of the uterus forwards. We can only relieve this state of things by pressing the head back during the pains, and also in the intervals, so as to allow the liquor amnii to flow freely. When the waters have completely escaped, the uterus becomes abundantly active in such cases.

There are certain mechanical conditions of the uterus itself which interfere with its efficient motor action.

In patients with a relaxed state of the abdominal muscles, particularly multiparæ, the falling of the gravid uterus forwards, and its suspension over the arch of the pubis, place the organ at a great disadvantage as regards contraction. In these cases the uterus at the full term is anteverted to such an extent as to hang down to the thighs, or even to the knees. In women thus affected, labour is very apt to be over-term, and when it does occur, it is prolonged and feeble. A great amount of pain and contraction of an ineffective kind is spent in getting the uterus into such a shape and position as to enable it to act on the fœtus. The supine position, the support of the abdominal parietes and the uterus by an abdominal bandage, and by the hand of the accoucheur during the pains, are the measures for remedying this form of gravid displacement. In patients subject to anteversion during pregnancy, care should be taken to prevent this condition as far as possible, by well-adjusted mechanical support to the abdomen, and by directing the patient to lie upon her back. Unless the fœtal head can be directed against the os uteri by these measures, the uterine actions are inevitably feeble during parturition. Dr. Ashwell relates, in his admirable work on the diseases of women, the case of a lady who had lost part of the abdominal muscles by ulceration, and who, on becoming pregnant, suffered from abdominal hernia of the gravid uterus. Her condition at the seventh month is thus described. "Through the aperture in the abdominal muscles the uterus had gradually passed, soon after rising out of the pelvis; and in proportion to its subsequent growth, the fundus had descended lower and lower, not covered, as in ordinary pregnancy, with the abdominal enlargements entire, but only invested with the peritonæum and skin; so that at this period the gravid womb formed an immense ovoid tumour, the greater extremity being inferiorly, reaching nearly to the left knee, the tumour gradually diminishing in breadth as it approached the abdominal aperture. The os and cervix were, however, within, so that there must have been great stretching of the uterine walls in the erect position, and there must also have been considerable curvature at this point." When labour came on, there were, as might have been expected, much time and pain consumed in consequence of the disadvantage under which the uterus acted. This case is but an exaggeration of what occurs in all cases of considerable anteversion, when, though the abdominal walls are entire, they are too distended to contract with proper energy.

Cases are on record of gestation with complete procidentia. Capuron relates one in which impregnation had taken place through the os uteri, and in which the full term of pregnancy was reached. At the time of parturition, the uterus, instead of being supported by the abdominal muscles, was left entirely to its own contractions, and these were insufficient to expel the child, which was at length removed by incisions made into the uterus.

Cases also occur in which the uterus is only partially developed, one part of the uterus being of the proper thickness and the rest exceedingly thin. Or the whole of the uterus is insufficiently developed, resembling the dilatation with attenuation, which occurs in cardiac disease. In a case of this kind the parturient actions are necessarily weaker than they ought to be, and little can be done to strengthen them. The labour is necessarily prolonged, unless the expiratory actions should happen to be unusually powerful, or the passages unusually relaxed. Indeed, if powerful uterine actions were possible under such circumstances, the danger of rupture would be very great. Feeble parturient action may be expected as the rule, whenever the fœtus can be felt with great distinctness during pregnancy, through the uterus and abdominal parietes. In such cases, the uterus and abdominal muscles should be supported by the abdominal bandage, from the commencement to the termination of labour.

Labour sometimes proceeds with inertia, in consequence of the os uteri being directed too far backwards. On introducing the finger during a pain, the os uteri can only be reached with difficulty, owing to its position. The head, or presenting part of the child, can be felt distinctly through the anterior portion of the uterine neck. Frequently three or four inches of the uterine wall can be felt in these cases between the pubic arch and the orifice of the womb. Whether this condition of the anterior and lower part of the uterus depends upon malposition of the organ, or upon some irregularity in its development during gestation, it would be difficult to say; but I am inclined to think that the anterior lip and the neighbouring portion of the uterine cervix are much larger and more extended in these cases than usual. In such a state of things, the stage of dilatation is necessarily tedious. It is as difficult for the resentation to get beyond this impediment, as it is to pass over an extended and rigid perinæum. After considerable delay, the partial prolapse of the uterus gradually recedes between the fœtal head and the pubic arch, or it returns suddenly with a jerk during the acme of a pain. To remedy this impediment, I recommend patients to lie upon the back during the pain, and, when it is possible, I endeavour with the forefinger to pass the anterior lip upwards above the pubis, in the intervals between the pains.

The irregular actions of the uterus and other organs, already described when speaking of metatastic and irregular pains, are often a source of tardy labour. Sometimes the uterus, instead of contracting as a whole organ, contracts at certain points, while it remains relaxed at others; and consequently the pains occur without any real progress to the labour. This partial contraction of the uterus can be felt through the abdominal parietes. It is removed by friction, the removal of intestinal or vesical irritation, with anodynes to allay pain. When the uterus is tender upon pressure, in the intervals between the pains,—the state of rheumatism as it is called,—it is sometimes necessary to bleed, in order to allay the disordered state of portions of the organ.

But besides all these forms of retardation, there is an important class of cases, in which the development and conditions of the uterus are quite natural, but still the uterine contractions are feeble and ineffective. There is no want of stimulus, the presentation, the condition of the fœtus, and the liquor amnii, being quite natural; nor is there any deficiency in the muscular structure of the uterus; but still the uterine action is below the physiological standard. There is a deficiency of the excito-motor principle. The stimulus and the muscle are in the normal condition, but the connexion between the two, by way of the excito-motor arcs, is inefficient. In what this deficiency essentially consists we do not know, as all that really takes place within the nervous structures is enveloped in mystery; but we can ascertain and remove many of its causes.

The causes of deficiency of excito-motor power, are,—

1. The condition of the reflex motor arcs, and the spinal centre. There may be feeble action, and even total arrest of

the action of labour, without any morbid condition which we can discover, in any organ or structure, except the nervous. We arrive at the nerves as the cause of delay by the exclusion of all other detectible causes.

2. The reflex-motor power may be feeble, from the age of the patient. In women who have borne several children, the motor power often increases in vigour with each parturition; but in females who become pregnant for the first time after forty years of age, the reflex-motor actions are generally feeble, and hence, as well as from the increased resistance, labour in such subjects is generally prolonged.

3. Emotion frequently deranges or altogether suspends the actions of labour. Emotion is the true Proteus of the animal economy. In no part of the system are its transformations more remarkable than in the reflex function, and especially in the actions of parturition. An emotional impulse, occuring in a labour otherwise perfectly normal, may either excite the motor actions to the pitch of general convulsion, or it may perfectly suspend them. The uterus may be acting with perfect vigour, but some emotional shock occurs, and suddenly contractions are suspended for many hours or even days. How often does it happen that the entrance of the accoucheur during the progress of labour perfectly suspends the uterine action for a time. In certain constitutions the reflex function is more mobile than in others, and in parturition it is, in the hysterical temperament especially, that these suspensions of action are most likely to occur. There is also an indirect mode in which emotion may retard labour—namely, when the patient is so timid that she spends the whole time of her pains in crying out, and consequently, by the open state of the glottis, interferes greatly with the respiratory actions.

4. Uterine action may be perverted or suspended by gastric or intestinal irritation, but particularly by the latter. It is matter of fact that intestinal accumulation, which in one case produces acute labour, and in another, violent extra-uterine action, shall in a third, arrest the action of labour entirely for a time. Everything depends upon the true diagnosis of these variable conditions of the uterus and the utero-spinal nerves. The enema which in one case, by removing fæcal irritation, allays the dangerous violence of the uterus, in another, rouses the torpid organ to a state of natural activity.

5. Debility may depress the spinal function to such a degree as to interfere with parturient action. But in debility a certain amount of relaxation or deficiency of resistance in the uterine passages generally runs parallel with the diminished reflex motor power, so that in many cases of weak reflex uterine action from debility, labour is little if at all prolonged.

6. The presentation has a marked influence on the development of reflex motor power. We see abundant reasons why the natural presentation of the head, and the retention of the liquor amnii until after the dilatation of the os uteri, should conduce to the greatest safety of both mother and child. As long as the membranes remain unbroken, the action of the uterus is moderate, and the fœtal circulation is little if at all interfered with, as compared with the interference of the subsequent stages. But as soon as the liquor amnii is evacuated, the fœtus becomes subject to pressure, both during the pains and in the intervals. The constitution of the mother is also liable to become disturbed during the passage of the fœtus through the pelvis and parturient canal. Thus, both on account of mother and child, it is important that the stages of propulsion and expulsion should proceed without delay. The greater the delay in these stages the greater is the danger to both mother and child. This delay is prevented by the irritation of the head in natural presentations, and by the excitor function of the vaginal nerves.

7. Other causes of deficient parturient action arise out of certain diseases with which pregnancy and parturition may be complicated; such, for instance, as chronic disease of the heart and lungs, in which the breath cannot be held to a sufficient extent, for the expiratory efforts of the propulsive and expulsive stages. Here the uterus loses all the stimulus of the expiratory pressure. The same happens in acute diseases of the chest at the time of parturition, when the expiratory efforts are prevented by pain, as in pleuritis or pneumonia. Ascitis, or disease of the liver, also interferes with the expiratory actions of the abdominal muscles. Paraplegia in the middle portion of the spinal marrow interferes with the actions of labour, by cutting off all communication between the uterus and vagina, and the medulla oblongata. Here the

uterine actions are rendered feeble, just as when the parturient function of the medulla oblongata is interfered with by thoracic or abdominal disease. In paraplegia from disease of the lower portion of the medulla spinalis, the actions of labour, uterine and extra-uterine, are almost if not entirely suspended. These points are abundantly proved by the records of cases of pregnancy in complication with paralysis.

But when either the breech, arm, hand, foot, or placenta, present, the uterine actions and the expiratory actions are feeble, in consequence of the diminished irritation supplied to the excitor nerves of the vagina and the os uteri. Hence the length of time which elapses in such cases before the rupture of the membranes, and between the rupture of the membranes and the expulsion of the child. This explains the increased fœtal mortality in extra-cranial presentations. The reflex function is only called forth to the proper degree when the head of the child is in the vagina, and in cases of breech or foot presentation, or in arm cases after turning has been performed, the reflex power is not fully in operation until some time after the umbilicus has passed into the vagina. In head presentations, on the contrary, the umbilical cord does not become subject to the full amount of vaginal pressure until the head has been born, and respiration has commenced. Thus, then, in all the extra-cranial presentations, the parturient actions are comparatively feeble, and from the retention of the particular presentation serious consequences to the life of the child arise. The uterine inertia from mal-presentation is greater in footling cases where both feet present, it is less in cases where only one foot presents, and still less in nates cases.

8. But still more important than any of the preceding varieties of uterine inertia, is the form of parturient inaction which sometimes occurs in the course of difficult or laborious labours, from exhaustion of the excito-motor power. In perfect health, the reflex action goes on with increased intensity up to the time of delivery. Every pain seems to be a stimulus to that which follows it. But in certain cases, when labour is continued beyond the usual time, when it has been excessively acute in the first instance, or when the patient is exhausted from any cause, the pains act as shocks to the

spinal centre, which becomes, after awhile, quite paralyzed. This may go to such an extent as to render the uterus quite immovable under any stimulus we can apply to it. In ordinary cases, it often happens that labour-pains are suspended, from temporary exhaustion, and after a period of rest resumed; but in more serious cases, the uterine exhaustion is permanent, and without assistance would never be resumed. The graver form of sinking may arise merely from the prolongation of labour; in others it is caused by the disturbance of the pelvic organs, or disease of the parturient canal from long continued pressure. The most serious form of all is that which accompanies, or, in fact, produces, uterine hæmorrhage. Not only is failure of excito-motor power a serious matter in itself, but is an indication of a critical state of the whole system. When decisive paralysis of the utero-spinal system has occurred during labour, it slowly extends to the heart and respiratory muscles, when death occurs from sinking. Thus continued failure of excito-motor power is as dangerous and fatal as its excesses: on the one hand, we have death from sinking, on the other, death from rupture and laceration. The treatment of this form of inertia, of course, consists of endeavours to re-excite the parturient actions, or of delivery by artificial means.

It has often been observed that delay during the propulsive stage of labour is much more dangerous than delay during the stage of dilatation. The dilatation of the os uteri, when there is no actual disease of the organ, may occupy many days without producing danger, but so soon as the vagina is involved, protracted delay becomes a serious matter. The reason for this has not been very clearly made out. The reflex-physiology of parturition appears to supply the explanation readily enough. While the uterus and the uterine nerves alone are involved, the effects of delay are almost confined to the uterus. But as in physiology we see the irritation of the vagina and vaginal nerves involve the respiratory system, and indeed the whole muscular system; so in pathology we see a corresponding extension of results from vaginal irritation. Vaginal irritation, combined with uterine excitement, is therefore more dangerous than uterine irritation alone. Not only are the constitutional relations of the vagina during labour more extensive than those of the uterus, but when the fœtal head has fairly engaged in the pelvis during the propulsive stage, the mechanical pressure and injury of the vaginal tissues are likely to occur, while little mischief could happen in the dilatile stage, with the vagina uninvaded, and the uterus defended by the liquor amnii. It is during the vaginal stages of labour, then, that sinking and failure of constitutional power are likely to occur, and it must be borne in mind, that the merely prolonged retention of the head in the vagina, without any local mischief of a marked kind, may prove dangerous, or even fatal.

What are the means which we possess of re-exciting the uterus to contraction when the pains flag, or cease entirely? When the uterine actions, previously strong, become feeble, a few hours' rest is the most simple remedy, and will often recruit the nervous energies, after which the labour is generally resumed, and goes on to a favourable termination. Rest from labour-pain, when accompanied by sleep, is still more certainly efficacious. We must, however, carefully distinguish between that amount of cessation from pain which may lead to resumption of the labour, and that which is allied to sinking. In the one, the pulse is good, the mind tolerably cheerful, and the stomach in such a state as to retain nourishment, stimulants, or febrifuge remedies; while in the other, the pulse is extremely quick and feeble, the mind does not rally, and the stomach generally rejects ingesta of all kinds. When it is thought advisable to allow a patient a few hours' respite from labour-pain with the expectation of re-exciting labour, a full dose of opium should always be given. It produces sleep, and at the same time stimulates the spinal centre. So that after sleep obtained from opium, the patient frequently wakes up, roused by a strong labour-pain.

During labour attended by feeble uterine contraction, we must adopt a different rule in making examinations from that which is proper in acute labours. The examinations should be more frequent and prolonged, being made with a view to increase the reflex actions, by supplying additional stimulus to the parturient canal; whereas in the present practice, I believe, a more constant digital attention is given to acute than to tardy labours.

I have already remarked that in tardy labours the liquor-amnii should be evacuated as soon as the os uteri has dilated, or even before this time if there is the tendency to dilate, or if the quantity of liquor-amnii be excessive. The membranes should be ruptured during the presence of a pain, as soon as the amniotic bag has been formed, as at this point of a pain there is greater probability that the whole of the liquor amnii will be expelled at once, so as to bring the solid pressure of the fœtus to bear upon the os uteri.

In feeble pains, the finger and thumb should be extended in the vagina before the advancing head, so as to distend the vagina at each pain. When the head bears upon the perinæum, pressure should be made upon the perinæum, so as to compress it between the hand and the presentation, with a view to excite the reflex parturient actions. As a general rule in labours with inertia, an examination should be made at every pain in the propulsive and expulsive stages.

The abdominal baudage is of considerable importance with reference to tardy labour. Some accoucheurs recommend its application in all cases during labour. I believe it ought always to be avoided as dangerous, in acute labour, until the uterus has been emptied of the fœtus, when the abdominal bandage and compress are exceedingly useful measures; but the bandage ought to be applied firmly, and reset from time to time, during the whole progress of tedious labours. The inert or energetic action of the uterus ought always to decide us respecting the application or omission of the abdomiual bandage. Stimulant enemata are often of the greatest service in exciting the torpid or inactive uterus. When there are fæcal accumulations, it takes away a cause of inertia, and when these are absent, it powerfully excites the uterus to reflex action. An abortion or a tedious labour, when apparently hopeless, may often be completed in a very short time by a túrpeutine enema. I look on enemata as most important obstetric aids, and I am sure they have not been sufficiently employed in practice. When the uterus is inexcitable in any other reflex manner, it will often act energetically at the time when the bowels are moved by an injection. We thus reproduce not only uterine contractious, but also the expiratory actions, which are so important in expelling the ovum. The enema syringe, I am persuaded, ought to take the place of the forceps in many cases where the forceps are now used, particularly in cases where the head is resting on the perinæum. It should be used, not merely with a view to evacuate the rectum and large intestines, but with a distinct view to the reflex stimulation of the uterus.

The position of the patient in tardy labour is an important point. She should be encouraged to sit, or stand, or move about the room, instead of being placed to lie down. During the pain her hands should be held, the feet fixed, and she should be encouraged to increase the reflex action of parturition, by holding her breath as much as possible, and by making voluntary efforts at expiration. When the bowels are opened by an enema, the patient should sit upon a night-chair during the action of the enema. By mere attention to position alone, during the various acts of parturition, we may increase the mechanical excitor action of the fœtus upon the parturient canal to a very great degree.

There is a mode of exciting increased reflex action of the uterus—first practised, I believe, by Mr. Simpson of Stamford—well deserving of notice. He applies cold to the abdominal surface, alternating the cold with warm applications, so as to husband and increase the excito-motor power. In the lower animals it is a common practice to inject cold water into the vagina in lingering cases; and if there were cases calling for such a mode of exciting the uterus in the human female, there can be no doubt of its efficacy.

The most celebrated obstetric adjuvant is without doubt the ergot of rye. This is a medicine of direct, and not of reflex, spinal action. It is of extreme value in cases when from the state of the passages there is no danger of laceration or rupture. Its action on the uterus through the spinal centre is as pecial as the influence of emetic-tartar upon the respiratory nuscles. Aloes, cantharides, and the ergot of rye, appear to affect the lower portion of the medulla spinalis, just as emetics, or expectorants, affect the medulla oblongata. As the ergot of ye affects the life of the child, either as a direct poison, or by nterfering with the materno-fœtal circulation, it should not be given, if possible, too long before the time of birth. The effect of the ergot upon the uterus is peculiar; it not only produces the intermittent pains of labour, but it constricts the uterus during the intervals between the active pains. On account of the influence of the ergot upon the child, it ought not to be used until the reflex modes of exciting the uterus had been tried in vain. Ipecacuanha has occasionally been used with the same intention as the ergot. With the vomiting it occasions, it produces uterine contraction. The bi-borate of soda is a remedy of the same action as the ergot of rye, but inferior to it in activity.

A mode of exciting uterine action by stimulating the muscular structure of the uterus directly has been practised by Dr. Radford, of Manchester. This accoucheur imitates the pains of labour by galvanic shocks passed directly through the substance of the uterus. The principle upon which galvanism must act when it produces contraction, is obvious.

In addition to all these modes of producing nervi-motor action, the strength of the patient must be sedulously supported by nutriment and stimulants, during prolonged labours.

When these measures, or such of them as may be suitable to the particular case, have been tried without effect; when the patient is sinking, (and in sinking especially, delivery is the remedy;) when the child's life is in danger; or when it is already dead; the forceps or craniotomy must be resorted to. The great aim of obstetrics is to resort to instrumental operation as seldom as possible, consistently with the preservation of the lives of mother and child. The greater the perfection we acquire in exciting the uterus to act physiologically, the more infrequent will obstetric operations become.

LECTURE XXV.

THE TREATMENT OF UTERINE HÆMORRHAGE:—I. BY EXCITING REFLEX UTERINE ACTION; II. BY DIRECT OR CENTRIC UTERO-SPINAL ACTION; III. BY EXCITING THE UTERINE MUSCULAR IRRITABILITY; IV. BY MECHANICAL MEASURES; V. BY ASTRINGENTS AND REFRIGERANTS. PROFOUND IMPORTANCE OF THE APPLICATION OF PHYSIOLOGY TO PRACTICE. PROPER ORGANIZATION OF REMEDIES.

Obstetric practice scarcely offers a more interesting field than the various hæmorrhages incident to gestation, parturition, and the puerperal state. My endeavour, in the present lecture, will be, to give a physiological account of the modes of arresting Uterine Hæmorrhage, and of the *modus operandi* of the most important agents which are used in Obstetrics, for this purpose. Uterine hæmorrhage evidently belongs to the class of maladies arising, not from excessive nervi-motor action, but from deficient nervi-motor power. The great object of treatment in this class of disorders is to arouse and produce this power. It will be seen that all the more important measures for arresting hæmorrhage from the uterus are intimately connected with the Spinal functions. I shall not enter upon the discussion of the causes of uterine hæmorrhage, or the sources whence the blood flows, except to say, that though it has recently been questioned, I know of no fact which shows that in the dangerous floodings of parturition the blood comes from other than the uterine arteries and veins, and chiefly the latter; and that the arrest of hæmorrhage consists in the mechanical or muscular closure of the vessels from which the blood is poured out. My observations are of course not intended to apply to the minor hæmorrhages from the maternal and fœtal vessels of the placenta.

I. The Different Modes of Exciting Reflex Contraction of the Uterus in Uterine Hæmorrhage.

Reflex contractions may be excited by stimuli applied to certain organs at a distance from the uterus; by stimuli applied to certain other organs and surfaces in the vicinity of the uterus; and lastly, by stimuli applied to the uterus itself.

I. THE MAMMARY NERVES.

The fact that irritation of the mammary organs will arrest hæmorrhage was known to Hippocrates. Mauriceau also makes mention of it. The explanation given was, however, that the hæmorrhage from the uterus became moderated, because of the revulsion of blood to the breasts. This could be of little real importance, if we consider the utmost vascularity of which the mammæ are capable, when compared with the large amount of blood which may escape from the uterus. The actions of the mammæ upon the uterus have been excited by sinapisms, by cupping-glasses, by drawing the breasts artificially, and by the sucking of the child. Of these the latter is the most effectual.

II. THE PNEUMOGASTRIC NERVE.

The gastric division of the pneumogastric is another remote excitor of the uterus. Its influence is chiefly seen after the delivery of the child, which is also the time when the flow of blood from the uterus is most profuse. Hot or cold drinks, or even taking food into the stomach, excites the uterus. I have no doubt the caudle of former times, though otherwise injurious, must have had considerable influence in contracting the uterus. Emetic substances taken into the stomach exert an influence upon the uterus; and ipecacuanha has long been known as a remedy in uterine hæmorrhage. Of all the gastric excitants of the uterus, the most useful is two or three ounces of iced water, suddenly swallowed.

III. THE LOWER INTERCOSTAL AND LUMBAR NERVES.

The cutaneous nerves of the abdominal parietes are excitors of the uterus in an extraordinary degree. The sudden impression of cold or heat upon the abdominal surface will almost always excite the most energetic contraction of the uterus affected with inertia, and from which hæmorrhage is taking place. We may contract the relaxed and diffuse uterus to a firm ball, by douching the abdomen with cold water from a height; or by plashing a towel, taken out of cold water, upon the naked abdomen; or by suddenly placing the hand, taken out of iced water, upon the umbilicus. If the surface of the abdomen should be cold, the sudden impression of heat produces a similar contraction. In all these instances it is the extremities of the cutaneous nerves of the abdomen which are affected by the stimuli. The result takes place too instantly to permit the belief that any sensation of cold or heat passes through the abdominal parietes to the uterus itself. The extremities of the cutaneous nerves of the abdomen are, in fact, almost as distant from the uterus as the superior intercostal nerves which supply the mammary glands.

About the true mode of action of irritation of the mammary and pneumogastric, and the superficial abdominal nerves, there can be no doubt whatever. These nerves are too remote from the uterus, in their peripheral extremities, to admit of any other explanation save that of the Reflex Function.

The next group of organs through the medium of which uterine hæmorrhage may be arrested by reflex contractions, are in the immediate neighbourhood of the uterus.

I. THE NERVES OF THE VULVA AND PERINÆUM.

Cold applied to the vulva, in any of the forms already mentioned, will excite the arrest of hæmorrhage. In the sanguineous discharges of early pregnancy, cold applied to the external parts is often useful, by favouring coagulation. Its refrigerant is, however, very different from its reflex action. In the former, the effect is slowly produced, and depends on the sustained influence of cold; in the latter, its effect is instantaneous, and depends on the repetition of the sudden impression of cold.

II. THE NERVES OF THE VAGINA.

If we pass the hand into the vagina, and close it so as to distend and irritate this canal, we induce contraction of the uterus. If we pass a lump of ice into the vagina, the same effect is produced. Cold injections into the vagina simply, are very efficient modes of restraining hæmorrhage. Plugging the vagina with linen or sponge soaked in cold or iced water, will sometimes arrest hæmorrhage, particularly in hæmorrhages occurring before delivery, or in cases of threatened abortion. Of course, one action of the plug is gradual and mechanical, and simply depends on preventing the flow of blood,—and thus favouring coagulation. But it has another action, causing contraction of the uterus. It is to this latter action that I am now directing attention.

III. THE VESICAL NERVES.

It is well known, that the injection of cold water nto the bladder will contribute to the arrest of uterine hæmorrhage, though there are many other modes of proceeding which are more eligible than this. I have no doubt that the injection of any irritant into the bladder, or the use of irritant diuretics, would have a similar influeuce upon the uterus.

IV. THE RECTAL NERVES.

In uterine hæmorrhage we may sometimes command the flow of blood by irritating the nerves of the rectum. This may be done by injecting cold water into the intestines, by the injection of purgative or stimulating enemata; and I have no doubt by aperients administered by the mouth, if time permitted their exhibition. The best mode of stimulating the rectum is by the injection of cold water, or the use of stimulant enemata, as salt-and-water, or turpentine.

This group of organs, it will be observed, is in the immediate vicinity of the organ from which the blood flows, and they are in great measure supplied by nerves having the same origin as the uterine nerves. But what I wish to insist upon is this, that all the actions I have been describing are *reflex* in their nature. Physiology repudiates the idea of uterine contractions, excited by means of continuity or contiguity of the organs excited, and the organ which coutracts. The peripheries of the nerves of the bladder, rectum, vulva, and vagina, receive the impression, and the iucident nerves, the spinal centre, and the motor nerves of the uterus distributed to its muscular structure, are all concerned in the muscular contractions which ensue. Though the organs excited are near the uterus, which contracts, the route of the nervous action is precisely the same as it was in the case of the stimuli applied to the mammary or the pneumogastric nerve. I make these observations because I still see the obsolete notion, which so long perplexed physiology, of referring all such actions to the sympathetic nerve, and to the mere anatomical distribution of nerves to neighbouring organs from the same source, cited by some authorities as sufficient to account for all such motor phenomena as those which take place between the different pelvic organs respectively. They look at the nerves interlacing and communicating with each other, and their minds do not reach to the necessity of considering the spinal centre as the organ which connects the peripheries of excitor and motor nerves, and without which their contiguity or distance would be equally useless.

I now come to the consideration of the contraction of the uterus, and the arrest of hæmorrhage by irritation of the uterus itself, through the medium of stimuli applied to—

I. THE UTERINE NERVES.

The power we possess over the uterus by this means is very great indeed, and the modes by which we can exert it are very various. We may excite the nerves of the external surface of the uterus, the nerves of the internal surface, or the nerves of the os uteri. When we produce uterine contractions by irritating the uterus through the abdominal surface, we act on the first series of nerves; when we inject cold water into the uterine cavity, we act on the second; and when we irritate the os uteri by digitation, we act on the third. These measures are of great importance in our attempts to rouse the uterus itself to action. We may excite the organ by introducing ice into the cavity, by injecting cold water into the cavity, or by injecting stimulating solutions. Dr. Arnott, of Brighton, proposed to place a bladder in the uterus, and then to inject the bladder, chiefly with a view to the mechanical distention of the uterus, and the arrest of the bleeding on mechanical principles. If, however, such a proceeding were operative at all, it would

MEDICAL

be on a different principle. Various substances have been proposed for injection into the uterine cavity, and I wonder it has not been proposed to inject the ergot of rye, particularly as it is said that M. Velpeau excited parturient action in the common fowl, by placing the ergot upon the sphincter ani. It would probably excite the internal surface of the uterus, just as sulphate of zinc excites the gastric mucous surface. Besides digital irritation of the uterus through the abdominal parietes, there is another external mode of inducing uterine reflex action, in the use of the abdominal bandage. The compression of the uterus thus occasioned increases uterine action, or evokes it when it has disappeared; it is certainly one of the best means we have of preventing that inertia of the uterus after delivery which so strongly tends to hæmorrhage. The introduction of the hand into the uterus, or the irritation of the os uteri by the fingers, or the whole hand, excites the uterus very powerfully. Besides the mere introduction of the hand, irritation of the internal surface of the organ by the tips of the fingers is sometimes practised. A very recondite mode of arresting uterine hæmorrhage was suggested by Sig. Mojon, an Italian physician. He proposed to inject the umbilical vessels with cold fluids or astringent solutions, and Professor Müller appears to speak approvingly of the practice. The very act of hæmorrhage itself sometimes supplies the source of irritation which prevents further loss of blood. After blood has been poured out, firm coagulation takes place, and the coagulum becomes a salutary irritant to the uterus. In this list of uterine local excitants, I may mention certain obstetric manœuvres, which, though often performed with other intentions, act upon the same principle as those which I have now been considering. For instance, in hæmorrhage occurring before the rupture of the membranes, the liquor amnii is evacuated. This is generally done with a view of lessening the size of the uterus, and of diminishing the quantity of blood which circulates in its structure, and also of bringing the child into immediate contact with the uterine surfaces, after the manner of a plug. But besides this, the body of the child becomes an excitor of reflex action. So also, in cases of placenta prævia, whether the rash plan of tearing away and extracting the placenta, or the old method of separation of the placenta and turning, be adopted, the hæmorrhage is arrested partly by the fœtus acting on the principle of a plug, but partly, and still more, by the contraction of the uterus consequent upon the irritation necessarily incurred in separating the placenta. When the placenta is extracted, the fœtal head comes into immediate contact with the excitor surface of the os uteri. When turning is resorted to, the extremities and trunk of the child become uterine excitors.

Now, in all these varied actions, the excitor nerves, the spinal centre, and the motor nerves are concerned. The uterus does not contract simply and singly from any inherent power belonging to the organ itself. Its actions from these sources of excitation depend mainly on its connexion with the spinal marrow. Doubtless there are other forms of action mixed up with those which are purely reflex, and to these I shall presently revert; but what I would contend for is, that much of the uterine action consequent upon irritation of the uterus itself, is as strictly reflex, as much produced through the medium of incident and motor nerves, and the spinal centre, as are the uterine actions caused by irritation of the mammary or rectal nerves. This is what I cannot too much insist upon.

III. The Different Modes of Exciting Direct or Centric Spinal Contractions of the Uterus, in Uterine Hæmorrhage.

1. If we administer a dose of the ergot of rye to a patient suffering from hæmorrhage, we observe, in many cases, that uterine contraction will follow. The fact has been known extensively enough, but the question has never been properly asked, How does the ergot act? or if asked, the question has certainly never been answered. It has been said, confusedly, that ergot has a special action on the uterine contractile fibre, or that it excites the nerves of the uterus; and these vague sayings have satisfied, or seemed to satisfy, the obstetric mind. I have no doubt that the true channel through which the ergot acts is the blood, and that the organ it reaches and affects, through this channel, is the spinal centre. We may illustrate its *modus operandi* by referring

to the action of emetic substances on the stomach. There are certain substances which, when taken into the stomach, immediately excite all the motor actions of vomiting. This happens, for instance, when sulphate of zinc comes into contact with the mucous membrane of the stomach. Sulphate of zinc, then, appears to excite the actions of vomiting in a reflex form. If there are any such medicines adapted to produce uterine action, by simple contact with the uterus, just as cold water does, they remain to be discovered. But again, in the case of the stomach, there are other medicines—the potassio-tartrate of antimony, for instance, which acts as an emetic only after it has been taken into the circulation, and which acts more promptly when injected into the blood itself. I believe the action of this medicine to be perfectly analogous to the action of the ergot of rye; that the one acts upon the medulla oblongata and the motor nerves of vomiting; the other, upon the lower medulla spinalis, and the motor nerves of uterine action. The ergot, therefore, is a remedy of centric utero-spinal action. We shall presently see that these inquiries in the mode of action of remedies are not without a practical use. The ergot, in addition to its utero-spinal action, sometimes produces vomiting, thus affecting the medulla oblongata, as well as the lower segments of the spinal centre, but it is remarkable that, though an excitant of motor action in these instances, it diminishes the frequency and force of the heart's action. This action of the ergot is favourable in some cases of hæmorrhage, but unfavourable in others, where failure of the circulation, and dissolution, appear to be imminent.

2. Ipecacuanha is another medicine which is sometimes given in uterine hæmorrhage. This medicine, by its emetic action, excites contraction of the abdominal muscles, and compression of the uterus, which in turn may re-excite some amount of uterine reflex action, but over and beyond this it appears to have a special action upon the uterus, increasing its contractile power beyond what we could imagine to occur from the merely secondary effects of vomiting. Ipecacuanha, then, appears to influence both the medulla oblongata and the lower medulla spinalis. This double action of ipecacuanha upon the two extremities of the spinal centre is very extra-

ordinary. It would be worth while to try, in uterine hæmorrhage, the effect of an injection of sulphate of zinc, with a view to ascertain whether it exerts the same specific influence of the lining membrane of the uterus and its nerves, as it does upon the pneumogastric nerve in the stomach.

3. Opium is also, in hæmorrhage, a remedy of direct spinal action. In moderate loss of blood it undoubtedly promotes uterine contraction, and arrests the hæmorrhage. A good deal has been said and written about this and other remedies acting beneficially, by equalizing the circulation of the blood; but this is an explanation utterly incompetent in the case of hæmorrhage from the uterus after delivery. Opium is an excitant of spinal action of the direct kind, and thus it is that its administration is beneficial in hæmorrhage, with uterine inertia, and injurious in puerperal convulsion, of the active kind. In both disorders its use and abuse have been empirical, and but little understood.

4. As a minor remedy of the same spinal relations as the foregoing, the biborate of soda may be mentioned. It may be said, briefly, that all stimulants taken into the stomach and received into the blood have a centric spinal action in hæmorrhage from the uterus.

5. But one of the most important agencies of a centric kind, and one different in its nature from the foregoing, consists in the influence of emotion. The former actors have been physical in their nature, this is purely psychical in itself, though its effects are evident in material motor contraction. In some cases of dangerous hæmorrhage, the mere arrival of the accoucheur in whom the patient places confidence, will be sufficient to contract, for a time, the uterus, and restrain the loss of blood. Hence the control of all outward signs of apprehension in the obstetrician is of the utmost moment to his patient. A depressed look, or a faltering word, may destroy a life which hopeful words and a strong will would have saved. It is remarkable, as exemplifying the influence of emotion, that when a hæmorrhagic patient is sensible, so as to know her child, the act of suckling the child is much more efficacious than when she is insensible; though, as I have shown you, insensibility in no wise lessens the vigour of the reflex actions. Where sensibility is present, the influence of emotion comes in

aid of the reflex action. It is also more efficacious for a woman to suckle her own child than that of another person. It is only the hopeful and confident emotions which excite muscular contraction. The depressing passions paralyze the uterus as well as other muscles, and they are, in truth, not unimportant as causes of hæmorrhage.

III. THE DIFFERENT MODES OF EXCITING UTERINE ACTION BY STIMULATING THE MUSCULAR IRRITABILITY OF THE ORGAN.

1. When we excite the uterus to contraction by the direct application of cold in any of the forms I have before adverted to, we produce, as I have explained to you, reflex actions, but we also call forth another power—that of the muscular irritability. Cold, applied to a muscle separated from the rest of the body, and denuded of nerve-fibres as far as possible, still contracts. Thus, then, in the direct application of cold, two distinct modes of contraction are appealed to—the one depending on the reflex function; the other, and more simple, upon the motor power inherent in the muscular fibre itself.

2. When we irritate the uterus mechanically, whether by squeezing the uterus through the walls of the abdomen, or by irritating the organ by the tips of the fingers; by simply introducing the hand into the uterine cavity, or by actively irritating the os uteri or the internal surface of the uterus by digitation, we invariably rouse the muscular irritability. We at the same time call forth a greater or less amount of reflex action, according to the excitability of the utero-spinal nerves; but this is invariably mixed with the increased action dependent on the excited muscular power. After death, when the nervous centres have lost their energy, this form of contraction may still exist, or it may be excited by direct irritation.

3. I have mentioned, on a former occasion, the fact, that in patients perfectly paraplegic, with entire loss of reflex uterine power, the uterus has been excited to contractions sufficient to expel the fœtus by means of galvanism. Dr. Radford, of Manchester, applied this power to the arrest of uterine hæmorrhage. One pole of a galvanic trough being placed within the os uteri, and the other applied over the fundus, it has been found, that on making and breaking the galvanic circle, power-

ful uterine contractions occur. It is said that the uterus can be made to contract by this agency when it will obey no other stimulus, and I have little doubt that this is correct. It accords with all we know of the influence of galvanism upon the muscular fibre. The contraction of the uterus from galvanism is probably the most simple mode in which we can act upon the irritability of the muscular fibre without complicating it with reflex actions. The reflex actions excited by passing galvanic currents through muscles are very slight, if they occur at all. This is proved by a great number of experiments. There is, however, one important disturbing agency, in the application of galvanism, which must be taken into account. The application of this remedy, and the painful sensations it excites, disturb the emotions considerably. In some cases the emotional excitement increases the influence of galvanism; in others, it weakens or suspends it altogether. This is probably the reason why, in some cases, galvanism has produced little or no contractile effect.

IV. THE DIFFERENT MODES OF ARRESTING UTERINE HÆMORRHAGE MECHANICALLY.

1. There are various modes of compressing the uterus mechanically, which are resorted to in cases of hæmorrhage. One mode is that of grasping the uterus through the abdominal parietes, and holding the organ so firmly as to prevent the further effusion of blood, while other means are being applied to ensure the permanent contraction of the organ. Another mode sometimes followed is that of introducing one hand into the uterus, and then exerting pressure with the other hand externally, so as to compress the bleeding portion of the organ between the two hands. A third mode of mechanical arrest, and one which is exceedingly useful, consists in the abdominal bandage, made to embrace the pelvis tightly, and having several towels or napkins, folded into a conical shape, placed underneath. I have mentioned to you the proposal to distend a bladder within the uterus, with a view to distend the uterus mechanically, and so arrest the loss of blood; but this seems to me to be mechanism carried to mischievous excess, and with a forgetfulness of the fact, that the distention of the

uterus must also distend the gaping mouths of the vessels from which the blood escapes.

2. Compression of the aorta, so as to cut off the supply of blood to the uterus, and prevent arterial hæmorrhage, has been insisted on by Baron Dubois, M. Chailly, and others. Several years ago, I pointed out that the directions given by obstetricians were wrong, and that we should make pressure upon the inferior cava instead of the aorta. The great hæmorrhages, those which kill, are from the veins, and not from the arteries, and further, not from the veins which are returning blood from the uterus, but from the vena cava and the heart itself. When the uterine veins are open, there is a great column of blood between the uterus and the right auricle, to the sudden escape of which there is no let or hindrance except uterine contraction. In those patients who have died from loss of blood, injections driven into the inferior cava from the right auricle readily escape into the uterine cavity by the uterine veins. Compression has been successful because it has been difficult or impossible to comply with the directions for pressing upon the descending aorta, without, at the same time, compressing the inferior vena cava. The compression of the great vessels is, however, at best, palliative, not curative, but it may give time for the application of other remedies.

3. The various forms of plugging the vagina and the uterus are a distinct class of obstetric remedies in hæmorrhage. Mechanical plugging is extremely useful in hæmorrhage in many forms of abortion, in certain hæmorrhages during delivery, and in cases of placenta prævia. The sponge or linen plug is useful in moderate floodings of the impregnated, and also of the unimpregnated uterus. This form of plug, when it fills the whole of the vagina, acts by preventing the escape of blood externally; this favours the coagulation of the blood effused behind the plug; and though the plug itself does not reach to the bleeding surface, the coagulated blood is converted into a secondary plug, which acts directly upon the mouths of the bleeding vessels. But besides the common form of tampon, we often convert the fœtus itself into a plug, having precisely the same mechanical action. Thus when, in hæmorrhage before delivery, we rupture the membranes, besides the other results, the body and limbs of the fœtus

come into direct contact with the hæmorrhagic tissue. So in placenta prævia, when the presentation is allowed to remain, but the placenta is torn away, the fœtal head becomes in effect a tampon to the os and cervix uteri of the most powerful kind. Again, when turning is performed in these cases, the feet are brought down, and engaged in the os uteri as a plug. These instances only differ from the plug of sponge or linen in their being more effective, and in being applied from within instead of from without. After delivery, no form of plugging can be of much service.

V. The Arrest of Uterine Hæmorrhage by Astringents and Refrigerants.

1. This exposition of the principles of treatment would be incomplete without referring to the action of astringents and refrigerants. These remedies, consisting of the acetate of lead, the mineral acids, alum given internally, and used in the form of injection, the sustained application of local cold, &c., are useful in all hæmorrhages which do not proceed from patulous vessels sufficiently large to require the contraction of the muscular organ in order to close them, or when the uterus is so little developed as to render its muscular contraction impossible. Here we are restricted to mechanical remedies and medicines of the class I am considering. Such are hæmorrhages occurring in the course of uterine disease, or in menorrhagia; uterine floodings in the early months of pregnancy; and the profuse lochial discharges which sometimes occur a few days after delivery, when the uterus has become perfectly contracted.

Such are the principal modes of arresting uterine hæmorrhage. They are more numerous and interesting than pertain to any other organ of the body. This is natural enough, when we reflect that the uterus is the only organ which secretes a sanguineous fluid physiologically, and that it affords the only instance in which large bloodvessels with open mouths, leading to fatal hæmorrhage, may be but the slightest conceivable divergence from a physiological process, in the separation of the maternal and fœtal circulations after delivery. You may observe the profusion of appliances which we possess for the arrest of uterine hæmorrhage. There is no other malady which can afflict the human frame, in which we have such an absolute fertility of remedies. Yet parturient women are constantly perishing from hæmorrhage. The truth is, that the many remedies for hæmorrhage have been so jumbled together, and so ill understood, that they have never been used in the systematic measure they really admit of. The methods of obstetrication have been ample enough, but the directions for their selection and combination have been very deficient. You have seen how susceptible all the remedies in this grave and important casualty are of physiological arrangement; how, indeed, the mere touch of physiology has been sufficient to marshal them in something like due order and proportion. It would, I am sure, be impossible to find any subject within the entire range of medicine, of equal importance, of which this might be said with more perfect truth.

Thus you see how profoundly physiology impresses itself upon our therapeutics in the treatment of uterine hæmorrhage. It will not do for those who are too idle to study the matter to say—We will be practical—we will leave the physiology of the question to be decided by others. Physiology protests against being thus postponed—it will not be put off—for it is inseparable from practice. Without a physiological comprehension of the points of treatment, what is likely to happen? In the arrest of hæmorrhage many remedies will probably be tried, either in succession, or in confused combination; but instead of a judicious combination of the several modes by which uterine contraction may be produced, mechanical means, or reflex or direct actions, will be trusted to alone, in such wise, that though many remedies appear to be used; only one or two principles—and those, perhaps, not the most important—will be invoked. It is just like the old Mithridatic formulary! Thus, suppose cold applied to the rectum, cold to the abdomen, iced water given the patient to drink, and the child placed at the breast: there is great appearance of activity, but in reality only the reflex action of the uterus has been excited, which would have been equally powerful if only one efficient mode of excitation had been tried. Or again, after one mode of reflex action had been tried in vain, the reflex function being exhausted, it would only be waste of time to endeavour to excite reflex action by applying irritation to other incident nerves; yet this is often done. We do not use *all* the resources which physiology places at our command, unless we call forth, in a dangerous hæmorrhage, the reflex spinal action, the direct spinal action, the irritability of the muscular fibre, and apply the mechanical methods of arresting the flow of blood from the uterus. If, for instance, instead of the jumble of reflex actions, we apply alternate heat and cold to the abdominal surface, give a dose of ergot, irritate the uterus through the abdominal parietes, and grasp it with the hands, we apply all the modes of inducing uterine contraction, and we thus get far more than a fourfold increase of contractile power.

LECTURE XXVI.

HÆMORRHAGE AT DIFFERENT PERIODS OF GESTATION. THE PRINCIPLE OF ALTERNATION IN THE APPLICATION OF COLD OR OTHER STIMULI TO EXCITOR NERVES. HÆMORRHAGE AT THE COMMENCEMENT AND THE EARLY AND LATTER MONTHS OF GESTATION. HÆMORRHAGE IN PLACENTA PRÆVIA. HÆMORRHAGE OCCURRING DURING LABOUR. PRINCIPLE OF THE ARREST OF HÆMORRHAGE IN PLACENTAL PRESENTATION. HÆMORRHAGE OCCURRING AFTER DELIVERY. CONCLUSION.

I NOW come to the consideration of the modes in which the various remedies for hæmorrhage are to be applied in individual cases. Having laid down the principles upon which the arrest of uterine hæmorrhage in all its forms must depend, much would still remain to be said about the measures proper in different classes of cases. No two events can be more different than uterine hæmorrhage occurring in the first month of gestation and uterine hæmorrhage taking place shortly after the delivery of the child, and the expulsion of the placenta. In the one case the stream of blood passing to and from the uterus is inconsiderable, the openings from which blood escapes are small, and if the uterus is not contractile, at all events it is not dilatile. But, after delivery, the circulating channels in the uterus are immense, and unless closed by uterine contraction, they must gape widely, and pour forth blood in full streams. We may consider the heart a contractile organ placed at one extremity of a large column of blood, and the contractile uterus at the other. Unless the uterus contracts and supports this column of blood, the result is just the same as though the heart itself were studded with perforations. The treatment of hæmorrhage at the commencement and termination of pregnancy must be as different as the nature of the loss of blood, and it must vary considerably in the different epochs of gestation.

A thousand facts testify, that although the stimulus which excites reflex action often excites sensation and emotion simultaneously, yet ordinary sensibility and its results are not at all concerned in the production of purely reflex motor actions. Some of the most perfect instances of reflex motor action occur when the part irritated has been separated from the cerebrum, or when sensation and consciousness have been perfectly suspended. But although common *sensation* takes no part in the production of the purely physical reflex spinal actions, another principle, that of *alternation*, is of the very highest importance in all the physical motor actions. A surface which is quite insensible to pain, manifests its impressibility when appealed to by an alternation of stimuli—by the successive application of heat and cold. If we wish to invoke the reflex function in all its power in any organ, the stimulus applied to it must be *alternated*. Dr. Marshall Hall insisted upon this in his New Memoir, and recently he has more fully shown the importance of this principle in Reflex Physiology. The application of the principle of alternation is of especial moment in all that relates to parturition. In natural labour, we see that at the close of each pain the uterus becomes unimpressible by the stimulus acting upon it, and the pain remits, until its impressibility is restored by an interval of repose. This is probably the explanation of the intermittent nature of labour-pains. In practice, the principle of alternation may be made of great service, and nowhere more so than in the treatment of uterine hæmorrhage. My able friends, Mr. Simpson, of Stamford, and Mr. W. F. Barlow, have both made some very interesting observations on the influence of heat and cold, when used in alternation, in exciting uterine action in uterine inertia. I believe Mr. Simpson was the first to point out the importance of the principle of alternation in exciting the uterus. In uterine hæmorrhage, neither heat nor cold, continuously applied, excites the full amount of uterine action. They must be applied alternately. A surface exposed to continuous cold becomes at length wholly inexcitor; but now, the application of heat becomes powerfully excitor, and after awhile the surface again becomes impressible by cold. In applying temperature to the arrest of uterine action by contraction, these facts should be constantly borne in mind. Whatever the excitor surface acted upon, cold and heat should be applied alternately. This plan both increases and husbands the reflex motor power. Some principle was necessary here, for it is astonishing how uncertain practice has been without such guidance. There has been an oscillation between the feeble and the rash application of cold. Dr. Locock has well remarked that when cold is applied, as it often is, by napkins, and these are suffered to remain, the heat of the parts soon converts them into a reeking fomentation, quite inadequate to the purpose intended. Of the error of this plan there can be no doubt. Dr. Arnott, of Brighton, a most ingenious physician, passes somewhat into the other extreme. He has recommended an apparatus for causing a constant supply of cold water to a small reservoir, to be applied immediately over the abdomen—the abdomen being placed under much the same conditions as it would be in the bed of a running stream, except that the water is not in direct contact with the abdominal surface. I ought, however, to say that Dr. Arnott perceives the influence the injection of cold water must necessarily exert in contracting the uterus. An additional reason, besides the superior effects of alternation, for avoiding the continued use of cold, is found in its depressing influence. When the powers of life are weakened by loss of blood, danger may arise from the sedative effects of cold. Obstetricians have often quoted the observation of Sir Richard Blackmore to Chapman, upon a case in which cold was used. "If you had used less cold applications, this patient would have died from loss of blood; and if you had continued them longer, you would have extinguished the powers of life." When we adopt the principle of alternation in the use of temperature, while we obtain the fullest measure of benefit, we avoid the constitutional effects of simple cold as a depressing agent.

Hæmorrhage at the commencement of pregnancy must be treated on nearly the same principles as menorrhagia. Cold should be applied continuously, with a view to produce coagulation, and to lessen the local circulation. Astringent medicines are useful, as in hæmorrhages from other mucous surfaces. The tampon may be used, but simply as a mechanical remedy, to prevent the escape of blood, and thus to favour coagulation at the mouths of the vessels. The uterus must be treated altogether as a non-motor organ.

In the early months of pregnancy, when the motor tissue of the uterus has been somewhat developed, hæmorrhages should be treated partly on the plan just laid down, and partly with reference to its contractile power. If necessary, in addition to the above modes of restraining hæmorrhage, and promoting coagulation, the flow of blood must be arrested by firm uterine contraction. We should choose the best measures for rousing the reflex and direct uterine action, and that form of action dependent upon its muscular irritability. Much must depend, however, upon whether the ovum has been expelled or not, and upon whether we have or have not abandoned the idea of preventing abortion.

In the latter months of normal gestation, plugging the vagina, both for the sake of its mechanical and reflex motor results, should be practised. The moderate application of cold, on the alternate plan, either to the vulva or the abdominal surface, or the use of a cold or purgative enema, will be proper. But nothing very heroic can be done, until it has been decided whether hæmorrhage is of sufficient importance to bring on premature expulsion of the ovum. This point once settled,—either that labour must come on in the natural course of things, or that it is justifiable to induce premature delivery artificially,—everything becomes simple. We should prepare for the direct action of the spinal marrow by administering a dose of the ergot, and then we should proceed to puncture the membranes. The latter measure, as I have already described, powerfully invokes the reflex actions of the uterus, and converts the body of the fœtus into an efficient plug.

In hæmorrhages occurring at the time of parturition, before the delivery of the child, these measures should, in severe cases, be had recourse to without hesitation. In many cases, however, simply rupturing the membrane will be sufficient. This should invariably be practised. I am here speaking of cases in which the placenta is attached to the fundus uteri.

When flooding during labour resists all the ordinary modes of arrest; when neither plugging, the alternate application of cold, rupture of the membranes, nor the administration of the ergot of rye, in suitable cases, is of any avail, we must evacuate the uterus, if possible, by turning, the use of the forceps, or even by craniotomy, if the life of the mother should be in imminent danger. In cases of placenta prævia, or in hæmorrhage after delivery, we have the source of the hæmorrhage somewhat under command, but in ordinary hæmorrhage during delivery, the situation of the placenta at the fundus uteri place it beyond our reach. We can only act directly upon it after the delivery has been effected. In turning, or applying the forceps, we do not arrest the hæmorrhage merely because we remove the fœtus, but because the reflex irritation of the hand of the accoucheur and the descending child, or of the blade of the forceps, and the force used in extraction, excites the uterus more powerfully than any other measures we can adopt. When the hæmorrhage continues after the artificial extraction of the child, it must be treated as an ordinary case of flooding after labour.

When the placenta is attached to the os or cervix uteri, the hæmorrhage which follows the separation of the placenta is called *unavoidable;* when the placenta is planted at the fundus, the hæmorrhage attendant on its separation is called *accidental.* There is, however, very little, if any, meaning in these two terms, thus applied. Whenever separation of the placenta has taken place, whether at the os or fundus uteri, hæmorrhage is *inevitable* and *unavoidable,* unless the uterus is either contracted, or unless some mechanical pressure is made on the separated surfaces.

In the hæmorrhage of placenta prævia occurring before the term of natural labour, the great object is to arrest the hæmorrhage, if possible, so as to preserve both mother and child until the end of gestation, or, at all events, until the fœtus becomes viable. At the time of parturition there is no safety but in the delivery of the mother, and repressive measures are only necessary until the uterus is in a state to admit of turning. The only modes of restraining or repressing hæmorrhage in placenta prævia, when the placenta has begun to separate, are by plugging the vagina, and keeping the circulation as quiet as possible. But the efficient remedy for the arrest of the flooding is delivery by turning. The very operation of turning converts the hand and arm of the operator into a plug, and when the feet are brought down, they and the body of the fœtus in turn plug the os and cervix so effectually, that further hæmorrhage is impossible. I am not here speaking of the propriety of saving the child, but of the mere arrest of hæmorrhage. When the placenta has been entirely separated, or is removed artificially, the head of the fœtus instead of the feet becomes turned into a tampon. Besides the plugging effect, there is, as I have before observed, a large amount of reflex action called forth by turning, or by the substitution of the head of the child for the soft placenta, at the os uteri. In turning, the muscular irritability of the uterus is necessarily stimulated. In these cases, the evacuation of the liquor amnii is to be avoided, if possible, lest it should render the turning more difficult; and the ergot of rye, and other centric stimuli, are improper, for the same reason. Where it is impossible to turn, and the life of the mother demands it, craniotomy should be performed. In these dangerous cases, promptitude in action is of the highest importance; here as in other critical enterprises, delay is equivalent to defeat.

In hæmorrhage from the fundus uteri, the separation of the placenta, which is the cause of loss of blood, tends powerfully to excite the uterus to contraction, from the direct effects of the separation upon the uterine tissue, and the reflex action it induces. It is only when the irritation caused by the detachment of the placenta from the uterus is not enough to excite efficient contraction, that any important hæmorrhage occurs. So in the case of placental presentation, the detachment of the placenta excites local contraction. There is not only the irritation of separation, but the lower segment of the uterus has been rendered unusually excitable by the increased development it undergoes from the implantation of the placenta in this situation. But in separation of the placenta at the fundus, the consequent uterine contraction is an unmixed good. In placental detachment at the os and cervix uteri the contraction is more abortive, and frequently mischievous. It does not entirely arrest the hæmorrhage, owing to the partial separation, and the soft mass against which the contraction is exerted, while it hinders the descent of the head in the form of a plug, often prevents the introduction of the hand for turning, and renders the subsequent extraction of the child by turning or craniotomy difficult, and sometimes impossible. Hence the uterine irritation and contraction excited by detachment of the placenta from different uterine localities is a subject of great importance. In placenta prævia, before the direct contact of the fœtal head with the lower segment of the uterus, the local contraction may be accompanied by considerable inertia of the fundus and body of the organ; hence the complication of placenta prævia with tardy labour.

This view of the mode in which hæmorrhage is arrested in placenta prævia after the detachment of the placenta, by orificial contraction, is supported by what we observe in turning in these cases. It often happens that in placental presentation, after entire or partial separation of the placenta, if turning is performed the os and cervix uteri grasp the body and neck of the child so firmly, as to render its extraction a difficult operation. It has sometimes occurred that mother and child have perished during the attempts to free the fœtal head from the contraction of the cervix. Again, in cases of placenta prævia the introduction of the hand for the purpose of turning is generally more difficult than usual, because of the rigid and contracted state of the os uteri. There is, then, every reason for believing, that the mode in which hæmorrhage is arrested in all placental separations, whether at the os or fundus, are the same—namely, the contraction of the uterine tissue at the seat of the separation. The active contraction of the os uteri from separation of the placenta, explains in part the arrest of hæmorrhage in some cases by artificial detachment of the placenta, if we could consent to destroy the fœtus by this measure. I believe the cause and nature of the increased motor action of the os and cervix in these cases, have to a great extent escaped observation; the rigidity has been considered simply mechanical, and the contraction accidental. The following case, from Dr. Robert Lee's Clinical Midwifery, a little work of the utmost value in obstetrics, beautifully illustrates the increased rigidity and contraction of the os and cervix uteri in placental presentation.

"On the 12th January, 1839, Mr. Jones, of Carlisle-street, Soho-square, called me to see a lady in the eighth and a half month of pregnancy, who had been attacked with uterine hæmorrhage a month before. It first took place without any accident or pain, and the quantity lost was about half a pint, and it produced little effect upon the constitution. She remained quiet for several days, and then got up, and only felt a little weak. For ten days she went about, but the hæmorrhage returned on the fifteenth day after the first attack, but not to a great extent. Seven days after this, a third and more profuse hæmorrhage took place. It gradually went off, but not so quickly as the other attacks. At one o'clock, 12th January, it was renewed to an alarming extent, without any pain; about a quart of blood was suddenly lost, and she became extremely faint. At four A.M. the discharge still continued. When I first saw her, at seven o'clock, she felt faint, the pulse was rapid and feeble. The upper part of the vagina was filled with a large clot of blood, which adhered to the os uteri. By displacing this at the back part, I could distinctly feel the placenta adhering all round to the neck of the uterus, which was thick and rigid, and very little dilated. The effect produced by the hæmorrhage was so great, that it was evident death would soon take place if the delivery were not speedily completed; and the state of the orifice was such, that it was certain the hand could not be passed, but with the greatest difficulty. At eight o'clock, Dr. Merriman saw her with us, and agreed that immediate delivery was necessary. I passed the right hand into the vagina, and insinuated my fingers between the uterus and placenta at the back part, and reached the membranes. *But the rigidity of the orifice was so great, that though I employed great force for a considerable time, I could not succeed in getting the hand into the uterus.* Dr. Merriman recommended rupturing the membranes, and I was proceeding to do this with the fingers, when I felt one of the feet of the child, which I grasped and brought down into the vagina, enveloped in the membranes, which then gave way. Nearly half an hour elapsed before the version could be completed, and when it was effected, *the neck of the uterus grasped the neck of the child so firmly, that I experienced the greatest difficulty in extracting the head*, and not till I had made pressure for some time with the finger, and dilated the orifice of the uterus. A great discharge of blood instantly followed, the placenta was removed, and every means employed to stop the hæmorrhage, but the breathing became hurried, the extremities cold, and she died in less than an hour after delivery. Dr. Merriman informed me, that a patient of his had actually died under similar circumstances, before the head could be extracted."

In this case it is most interesting that there should have been such a great amount of orificial *rigidity* before the uterus had been entered by the hand, and such a great amount of *contraction* afterwards, when the head of the fœtus came to pass through the os and cervix. I have no doubt the rigidity chiefly consisted in a state of active contraction. If the case had been one of simple mechanical rigidity, the cervix uteri would scarcely have been affected by sudden and violent contraction immediately after its mechanical distention. We might as well expect the rigid perinæum to contract after its distention by the fœtal head. A case of uterine rigidity, reduced by mechanical means, is the least likely of all to be followed by spasmodic contraction. Dr. Lee says, that in some of these cases of placenta prævia, the os and cervix grasp the fœtus like a rope.

Hæmorrhage occurring after delivery, from the entire or partial separation of the placenta, with uterine inertia, calls for all the resources of our Art. If the placenta should only be partially separated, that viscus should be entirely detached and removed. This operation, by exciting the muscular and reflex powers of the uterus, will often arrest the hæmorrhage at once. When hæmorrhage occurs after the complete evacuation of the uterus, the inertia upon which it depends may be either partial or entire. When the inertia is partial, the uterus contracts sufficiently to expel coagula or large gushes of blood from time to time, thus giving palpable evidence of the jeopardy of the patient. But in total inertia, there is a discharge of blood per vaginam; the uterus is too feeble to expel the vital fluid effused into its cavity, and the organ becomes immensely distended and diffuse. The beat of the heart fails or ceases, the temperature falls suddenly, the functions of the brain are suspended, and the patient is suddenly precipitated into the very jaws of Death.

In either case, whether the hæmorrhage be internal or external, if it has taken place to a dangerous extent, the vital powers must be carefully and instantly preserved, and every possible measure taken to prevent further loss of blood, and to ensure the contraction of the uterus.

The vessels of the uterus should either be compressed mechanically, between the hands, or the venous and arterial flow of blood from the heart should be prevented by pressure on the aorta and inferior cava.

Stimulants (brandy, as the strongest, is the best) should be given by the mouth; the head of the patient should be kept low, as the continued action of the heart will depend greatly on the state of the cerebral circulation. The inferior extremities should be raised, and it has been recommended to place ligatures, or tourniquets, upon the extremities, in order to reinforce the circulation as much as possible. As quickly as may be, the ergot of rye should be given with the stimulants, to ensure the direct action of the spinal marrow upon the uterus. This form of action may be excited even after the uterus refuses to obey stimuli of reflex action.

The reflex actions should be excited by *alternate* cold douching and warm applications to the abdominal surface and vulva, and by the application of the child to the breast, or by causing the nurse to suck the breasts. The drinks should be given cold or iced, to stimulate the pneumogastric nerve.

The muscular irritability of the uterus should be stimulated either by irritation through the abdominal parietes, the application of galvanism, or the introduction of the hand into the uterus. Where the latter is resorted to, the uterus should never be injured by improper pressure. Irritation, not force, is required!

As a last resource, transfusion has been recommended in these cases; but it is at such moments, above all others, that we require instant remedies, and transfusion is, alas! an operation causing more time than life will often wait for. We may suspect that in the fortunate recoveries by transfusion which are on record, the patient would have recovered by other means.

Here we have exhausted and combined all our most potent remedies; but they will rarely fail, when properly directed, unless, indeed, the patient is already cadaveric when they are commenced. As there is no malady in which the sudden danger to life is greater than in uterine hæmorrhage, so, most fortunately, there is no contingency in which the resources of Art are more powerful or numerous.

* * * * * *

I now bring the present Course of Lectures to a conclusion. I have experienced considerable difficulty in attempting to advance, even by one step, a department so extensive as that of Obstetrics. This, however, by the help of physiology, not heretofore applied in this department, except in the most cursory manner, I have striven to accomplish. Whether I have succeeded in placing this branch of medicine on a physiological basis, sufficiently broad to influence practice, time alone will determine. I feel sanguine, however, as to the result. Since the commencement of the publication of these lectures, I have received much encouragement from distinguished members of the profession, (many of whom were strangers to me,) expressive of their approval of the principles I have endeavoured to enunciate. These flattering encouragements will embolden me to pursue still farther the development of physiological doctrines in the direction of Parturition and Obstetrics.

APPENDIX.

MANCHESTER MEDICAL SOCIETY

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Some of the following notes, which I have thrown together in the form of an Appendix, will be found to elucidate certain points treated of in the preceding Lectures.

Ovular Theory of Menstruation.

In the January number of the "British and Foreign Medico-Chirurgical Review," the ovular theory of menstruation is referred to in a review of Drs. Ashwell and Meigs. An objection is taken to the periodic maturation and discharge of ovules in the human female, partly on the grounds of certain circumstances relating to the period of impregnation in Jewish women. The Reviewer observes :—

"It has yet to be shown that the human female is the subject of a periodic æstrum once a month, and that at this time vesicles are maturated and an ovum discharged, which may be impregnated during its slow progress through the sexual organs, whenever it may come in contact with the semen. We believe that about eight days is given for this transit of the ovum, which, in fact, limits the period of conception to this time after the menstrual period. And yet the Jewish women who are bound to observe continence for just this time after menstruation, are notoriously a prolific race !"

In the "Lancet" of December 14, 1844, there is a communication by Dr. Girdwood, which contains some important facts respecting this question. I quote the following from Dr. Girdwood's paper, as it meets the difficulty started by the Reviewer:—

"That conception takes place about, and most probably antecedent to, the time of the periodic discharge, is illustrated, on a great scale, by the nation of the Hebrews. It is the custom amongst Jews, who are scrupulous, for the wife to retire from the society of her husband for a period of thirteen days, reckoning from the first day of being "nyddar"—that is to say, by those who are strict, five days are kept, as prescribed by the Rabbinical law, (for the purpose of making security doubly sure,) in addition to the eight days enforced by the law of Moses. I have it from most excellent authority, from individuals of this nation, for whose probity of conduct and veracity I have the highest respect, that after extensive inquiries made amongst their friends and relations, they find, that no pregnant female, observant of this Rabbinical law, can calculate within fifteen days when to expect her accouchement. In fact, that event generally takes place a fortnight later than expected; and this is accounted for when we learn that the Jewesses reckon their gestation from the day of their purification, and not, as the Christians, from the time that the catamenia were last evident—that is to say, from the time *when the impregnability of the ovum was last at its acmé*. I was led to this inquiry, from having remarked, that an Israelitish married woman I had for years attended during her confinements, gave birth always later than the period of her reckoning. I may add, as a fact, that in general, among this singular people, no female is found to be a mother before at least *nine calendar months and a half* have elapsed."

The subjoined extract is from a letter addressed to me by Dr. Power, and it is in the main confirmatory of the opinion expressed by the reviewer on the point to which it refers:—

"There appears one discovery still necessary to render the ovular theory of menstruation perfect:—namely, the detection of the ovule in the menstrual discharge, or in the vagina at the time of menstruation. All the dissections which have yet been made tend only to confirm the original observations of Kerkringius and Cruickshank, relating to the bursting of the Graatian vesicle. Indeed, I am not satisfied that the bursting of a Graatian vesicle and escape of the ovule of Baer is the general occurrence or Law, and am inclined to believe that the ovule, when impregnation does not take place, having lost its vitality, is not unfrequently absorbed within the ovarium."

In three cases in which Dr. Ashwell had opportunities of examining the ovaria of women who died during the flow of the catamenia, there were no signs of the rupture of Graafian vesicles, and the escape of ovules. In one of these cases, the woman had menstruated regularly for several years, and yet the ovaria were perfectly smooth; "there was neither rent nor cicatrix marking the site, either of a present or former maturation and escape of a Graafian vesicle." Still Dr. Ashwell admits the periodic return of ovarian excitement as the condition of menstruation, though this excitement may not always reach the point of maturing and discharging ovules.

ABDOMINAL MOVEMENTS OF PREGNANCY.

One of my students, distinguished for his diligence and accuracy of observation, has supplied me with the following note:—

3, Great Queen-street, Westminster, March 1.

DEAR SIR,—My brother, (a farmer in the country,) for a great part of the year waters his cows from a cold gravel spring, of which water they drink several gallons each, twice a day. It is whilst they are drinking of this water, (always intensely cold,) that the strong jerkings and apparent kickings take place in the flanks of the cows near calving; and these motions, seen so frequently at such times, are observed on no other occasion.

Dear Sir, yours, very obediently,

WM. K. PARKER.

To Dr. W. Tyler Smith.

Can it be that the cold affects the fœtal calf, or is it that reflex uterine contractions are excited through the medium of the stomach? I suspect it to be the latter. I know it has been asserted that taking food and drink into the stomach of the pregnant woman excites reflex actions of the fœtus. But this is clearly impossible; there can be influence of temperature between the human stomach and uterus; and where is the reflex arc extending from the pneumogastric, to the muscles of the fœtal limbs? Such movements are undoubtedly reflex uterine actions. I would have it distinctly understood, that I do not deny the existence of fœtal movements before the time of birth. What I contend for is, that a large amount of motor action, which has hitherto been attributed to the fœtus, does in reality belong to the gravid uterus.

PRECIPITATE ABORTION.

A case occurred during the loss of the "Ocean Monarch" by fire, which illustrates the rapidity with which abortion may take place during death from asphyxia. The following is a description of one of the bodies found a few days after the loss of this ill-fated vessel:—

"The deceased is of slender make, having on her head a Dunstable bonnet, and a dress of blue, hail-showered print, blue cotton skirt, or top petticoat, and red flannel under petticoat, and a red-and-white woollen plaid shawl. Under her dress, she had on a man's waistcoat of woollen cloth, with a small red flower on a light ground, and small metal buttons. On the wedding-ring was a gold ring, marked on the inside with the initials 'G. W.' Round her neck was a double row of coral neck-beads, with a gold clasp, and her hands appeared much scorched. *This woman had been thrown into premature confinement, and was partly delivered of a child, which was brought with her on shore.* She appeared to be about forty-three years of age."

TWO CASES OF AMYELITIO FŒTUS.

CASE 1.—A case of amyelitic fœtus has been kindly forwarded to me by Mr. Hoadley Gabb, of Hastings, which is quite as important as M. Lallemand's case, (p. 102,) and bears equally strong upon the question of the fœtal movements.

"It will afford me much pleasure to give you a history of the case your letter referred to, which was not only interesting to me, from the malformation of the fœtus, but also from the mother (who had previously had four healthy children) having attained a most enormous size, so that the abdominal parietes appeared on the verge of sloughing from distention; this was subsequently accounted for by the immense quantity of liquor amnii.

" Another feature of the case was new to me, and occasioned me some anxiety. The uterus remains as enlarged for some days as that of a woman six months advanced in pregnancy; and for a night and day after delivery as much liquor amnii was discharged, though without pain, as is usual at an ordinary labour.

" The placenta came away easily; there was no hæmorrhage. The fœtus, which was within a fortnight of its proper time, according to the mother's calculations, was small; it presented these peculiarities :—

" The head was placed without the intervention of a neck between the shoulders, so that the chin rested on the sternum. The face was natural, excepting being broader than usual.

" The skull consisted only of the frontal, the inferior portions of the temporal bones, (there were no squamous portions,) and the anterior half of the occipital bone, so that there was no foramen.

" The brain was large enough to fill the skull if it had been perfect ; it was merely covered behind, apparently by its membranes. The hemispheres were as plainly divided by the falx cerebri as they usually are on the removal of the calvarium.

" My impression is, that there was no cerebellum, but of that I am not quite certain.

" The posterior portions of the cervical and dorsal vertebræ were wanting; they appeared as if the integuments, together with all the vertebræ, excepting the bodies and transverse processes, had been removed with a knife, and had recently cicatrized.

" The ligamentum nuchæ was divided into two fasciculi, and attached to the transverse processes.

" *There was no spinal cord, nor any rudiment of one; the bodies of the vertebræ were only covered by a thin, semi-transparent membrane.*

" The other portions of the body were normal.

" *The apparent motions of the fœtus were so evident a day or* *two before its birth, that the mother drew her husband's attention to her dress being raised by them.*

"These are all the peculiarities that a superficial examination afforded. Circumstances would not permit me to dissect the fœtus, which I much regret.

"P.S.—From the little resistance offered by the formation of the head of the child, I was not there until half an hour after its birth, as my house is a mile from where the mother resides. The child, the nurse informed me, was born dead, and, indeed, from the fact of the blood being coagulated in the funis, must have been so some time prior to its birth, as labour was very rapid."

Case 2.—I have received the following particulars of another highly interesting case of amyelitic fœtus from M. Constantine Zaviziano, Professor of Midwifery in the Ionian University, Corfu. In a letter addressed to me, he writes:—

"I am fully aware of the opinions which you entertain in respect to the abdominal movements commonly attributed to the fœtus, which are observable during pregnancy; and having perused with much interest the case published in the 'Lancet' (vol. ii. 1848, p. 400), with your remarks thereon, I take the liberty of bringing under your notice another case of amyelitic fœtus, which fœtus I still have in my possession.

"The mother of the fœtus in question is about eighteen years of age; this was her first pregnancy, *from the third month of which she began to feel abdominal movements, and these continued to increase up to the seventh month,* when she miscarried without any apparent cause. The movements were so strong during her pregnancy, that they were not only felt, but were visibly apparent to the mother and her attendant. From the following description of the fœtus it must absolutely be retained, that the movements could not be other than those of the uterus, and therefore quite independent of the muscular contractions of the fœtus. Likewise the movements felt by the mother in the third month of pregnancy could not well be attributed to the fœtus, on account of the small development of the muscular system at this time. In addition to what you have stated in your Lectures, published in the 'Lancet,' I also beg leave to subjoin, that there can be no practising physician who has not known of pregnant women who first became aware of the fact of their having conceived, from feeling unusual abdominal movements in the first stage of pregnancy; and others again, who feel such movements without having conceived, in consequence of some other extraneous body existing in the cavity of the uterus.

"The miscarriage to which I have alluded took place without any dangerous consequences to the mother. The fœtus is of the usual size; the neck is entirely wanting, and the head appears to rest between the shoulders, with the face upon the sternum; the face is most hideous, the mouth very wide, from which the extremity of the tongue is observable; the base of the nose is large, and flattened out; the eyes are large, and protruding much from their sockets, with a space between them of about nine lines; the ears are well formed; there is no frontal bone, but the inferior portions of the temporal bones exist, without any squamous portions, however; the sphenoid bone exists, likewise, and the anterior half of the occipital bone. Of all the vertebral column, nothing is to be found but the bodies and the transverse processes. The basement of the cranium, as above described, and the anterior part of the vertebral channel, were covered with a species of semi-transparent membrane. *There was no trace of brain, cerebellum, or spinal marrow.*

"And now, having brought this case of amyelitic fœtus, which I trust will also prove of some interest, before you, permit me to subscribe myself, &c., &c."

This case is remarkably similar to that published with engravings by M. Lallemand.

Such cases prove to a demonstration that abdominal movements of gestation cannot in all cases be attributed to the fœtus; we are obliged to refer them in these cases to the uterus. Time was, when the absurd notions that the fœtus sat upright in utero during pregnancy, and that, at the time of labour, it assisted by its own efforts in its emergence from the womb, were as universal as the present belief that the abdominal movements belong entirely to the fœtus. I am convinced that more correct observation will prove the latter to be, in its exclusive sense, as untenable as the former, of which, indeed, it seems to be a relic.

Cause of Labour.

The following extract from Dr. Fleetwood Churchill's work on the "Theory and Practice of Midwifery," shows how perfectly the idea of the regular duration of pregnancy, and the relation of parturition to the catamenial periodicity, may exist, without any idea of the cause of labour. Dr. Churchill is perfectly conversant with "the fact," that the average duration of labour is 280 days, or a time equalling ten catamenial periods; and he suspects that labour comes on at the tenth period after impregnation, but "the exciting cause" is quite undiscovered. It is the knowledge of an excitor spinal nerve in the ovarium which is the one great point wanting, and without which the mere fact of periodicity is confused and of little value.

I insist upon this point strongly, because attempts have been already made by those who confound *cause* with mere *coincidence and time*, to set aside my claim to whatever merit may lie in the detection of the Cause of Labour. The passage I quote, proves that it is quite possible to have a tolerably accurate notion of the "utero-ovarian periodicity" of pregnancy, and yet to consider that "all search has hitherto failed in discovering the exciting cause of labour." Obstetricians might have gone on, as they had done before, from generation to generation, repeating to themselves the fact, that the duration of gestation is a multiple of the catamenial period, without any conception of the ovario-uterine nervous arc, which excites the uterus to parturient action. Dr. F. Churchill commences his chapter on Parturition thus:—

"We have now arrived at the last great function of the uterine system—that of Parturition, with its abnormal variations.

"It consists in the expulsion of the fœtus and its appendages from the cavity of the uterus, and effects the separation of the child and the mother.

"It occurs, as we have seen already, at the end of nine calendar months and a week—ten lunar months—forty weeks, or 280 days, a few days being allowed either way.

"The magnitude and importance of the event, and the regularity with which it takes place, have induced physiologists of all ages to assign causes for it, but as yet without success.

"Thus it has been supposed that the uterine action is excited by the struggles of the fœtus for the want of adequate nourishment, or from the constraint of its position, or from the endeavour to breathe: by others it has been attributed to the acrid nature of the liquor amnii. Buffon has likened the process to the dropping of ripe fruit. Hervey, Burdach, and others, attribute it to the uterus having attained its maximum of irritability at the exact time that the fœtal development is complete. It would be easy to fill pages with similar explanations, but these may suffice: they are all either more elaborate expressions of the fact, or mere hypotheses.

"But though all search has hitherto failed in discovering the exciting cause of labour, it has established the fact, that the periodicity which we found to characterize the other uterine functions, prevails here also. For example, abortion or premature labour, when not the result of external accidental causes, occurs very generally at a monthly, or what, but for conception, would have been a menstrual period.

"Again, as remarked by Stark and others, the normal period for parturition corresponds to a menstrual period; on this principle Klugè calculates the duration of pregnancy in every case at 280 days, and so much more or less, as impregnation took place immediately before or after menstruation. Speaking generally, labour may be looked for at about the tenth period after the last appearance of the catamenia.

"Lastly, in extra-uterine gestation, an attempt at labour occurs very generally at about the same period.

"So that, taking the monthly discharge as the type of utero-ovarian periodicity, we may observe that it continues, though at times less demonstrably, throughout the whole period of the functional activity of the sexual system."

Emotional Contagion in Puerperal Convulsion.

There can be no doubt but that puerperal convulsion may extend from one patient to another through the influence of emotion, like epilepsy, chorea, stammering, and some other spasmodic diseases. There is one remarkable instance of this on record, possessing an historical interest. Convulsion occurring after a tardy labour, depending on the arrest of a large fœtal head, in a pelvis below the average capacity, was the cause of the death of the Princess Charlotte in 1817. After her decease it is well known that convulsions were unusually prevalent among puerperal women, particularly in the higher circles. All women went into labour under the influence of the terror excited by an event which in that day was felt as a grief at every fireside. I believe that within a short time subsequent to this melancholy accident, two or three other fatal cases of puerperal convulsion occurred in the practice of Sir Richard Croft, and led to his suicide. A misfortune, relentless as the ancient Ate, pursued to the grave this accomplished physician, who a few years before had entered upon a seemingly brilliant career, as the son-in-law and successor of Denman, and the brother-in-law of Baillie.

PECULIAR MALADY INCIDENT TO THE DECLINE OF THE CATAMENIA.

There is a peculiar malady which has never been described, belonging to the period of "the change of life," or the catamenial crisis, and allied in its nature to sphagiasmus, which I shall take some future opportunity of elucidating fully. The so-called "heats and chills" of this period consist of a real paroxysmal affection, allied in its nature both to intermittent fever and epilepsy, particularly to the cerebral variety of the latter; sometimes it terminates in epilepsy, or mania, or even apoplexy. In fact, this malady is a fruitful source of mania occurring in the female after the decline of the catamenia. The disorder I refer to appears to consist of compression of the veins of the neck, and distention of the cerebral circulation, attended by vivid sensations of heat, flushing of the face and neck, with giddiness, almost amounting to insensibility. These symptoms are soon followed by relaxation of the neck; great coldness or chills, and faintness, with perspiration, over the whole surface of the body. The paroxysms are sometimes so violent as to wake patients out of their sleep, and the apprehension of the attack produces the greatest uneasiness in excitable patients. These paroxysms occur many times in the twenty-four hours, in women of delicate health at this epoch. Let any practitioner inquire and analyze the symptoms of women at the catamenial decline, and he will find the affection of which I have given the outline to be very common; it is a most important subject of study, as being the basis of many of the disorders of the nervous system, which occur after the cessation of the catamenia.

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